Interoperability of Services in an Open Broadband Market; Cases from the Netherlands

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Synopsis: End-to-end interoperability of broadband services and networks is a condition for an open broadband market. A business model for broadband service interoperability is given. Two cases from the Netherlands, of initiatives from the market to reach interoperability, are presented: E-norm and FIST VoIP

Keywords: *broadband service, policy, business, Voice over IP, standardization, interoperability*

Abstract

The information society is enabled by broadband communication among consumers. This is an important worldwide priority. The first step is the achievement of a high penetration of households connected by a broadband access network. This step is already being made in the Netherlands. In a mature broadband market consumers may want different service providers for several services, may chose different access providers using several access technologies and they may want to have different electronic devices which should easily come on-line using several home networking standards. If these consumers want to communicate with each other and want to share content and applications, there is potentially a huge interoperability challenge! Thus, the next step to be made in the information society is to get an open market with many players offering a variety of broadband services, applications and content.

In this paper we will give a business model for an open broadband market and we describe service interoperability on two levels: interoperability between different access networks and interoperability between different service provider platforms. These are followed by the description of two cases from the Netherlands of taskforces formed by different players in the market aiming to harmonize choices in their networks and platforms. The basis for these agreements is the common interest of these service providers to enlarge their potential consumer market and to make their broadband services more attractive to their existing customers.

With interoperability between different access networks, consumer A and consumer B have different access providers using (in principle) different access technologies. They want to use a common service, like telephony (voice over IP), online-gaming and multimedia content sharing. In the Netherlands the taskforce "E-Norm" is making a reference model in which agreements between network and service providers and their vendors are settled. The aim is that service providers are able to offer their broadband services in all parts of the country over different access networks. The approach of this taskforce starts by consultation of service providers to get the most important service characteristics. Each service characteristic leads to preferences for certain choices in the access networks. For some service characteristics impediments in some network technologies are observed. Both the harmonized choices as the impediments are formulated in the reference model.

With interoperability between different service platforms offering the same type of service, consumer A and consumer B have different service providers, both having their own service platforms. An example is the Voice over IP (VoIP) service. In the Netherlands the taskforce "VoIP-technical" is making appointments between VoIP service providers to reach optimum VoIP service interoperability. They have chosen to use the SIP protocol for the wholesale interconnection of VoIP traffic. Doing these they don't need to use a gateway and an intermediate TDM connection to the fixed network anymore; they can peer their voice traffic directly.

Preface

The B@HOME project is part of the Freeband Communication programme, which aims at the generation of public knowledge in advanced telecommunication (technology and applications). Freeband is based on the vision of 4G networks and services. It specifically aims at establishing, maintaining and reinforcing the Dutch knowledge position at the international forefront of scientific and technological developments, addressing the most urgent needs for research and novel applications in the present unfolding of new technology. Freeband comprises more than 25 organisations, including all-important technology providers and many representative end-user organisations. The Dutch Ministry of Economic Affairs is co-funding this programme as part of the BSIK plan.

The vision for Freeband for 2010 is to consider communication and information transfer from the perspective of the user, not the provider. The communication infrastructure will become transparent and abundant in all its layers.

B@Home's scope is future broadband services for the residential user, with a focus on the entertainment domain. The objectives of the project are to develop new business models as well as architectures capable of plug-and-play service delivery to the end-user.

The knowledge and experience gained in the project will be used to implement a demonstrator to show some of the future advanced services. In B@Home, Lucent Technologies, Philips Research, LogicaCMG, the Technical University of Eindhoven, Erasmus University of Rotterdam and TNO work together to achieve these results. The project started on July 1st, 2004 and has a duration of four years. After two years, the first demonstrator will be presented.

This white paper is the first result of activity T0.3 "Integrated Broadband @ Home overview", producing white paper documents describing the main results and open activities of the project B@Home and related projects.

The paper has been peer-reviewed and accepted for presentation at the 17th European Regional ITS Conference, August 22-24, 2006. Amsterdam, the Netherlands.

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1 Introduction

1.1 Conditions for an open broadband market

The international market of broadband communication is evolving at a very high speed. This is often illustrated by the high growth of number of households connected by a broadband access network to the internet. Broadband penetration figures per country play an important role in comparing the countries in terms of broadband ICT adoption. However it says nothing about the real use of services and applications at the households. Furthermore it tells us nothing about the variety and economic volume of the market of service and application providers. Also it tells us nothing about how competitive and open the broadband market already is. If the broadband market has to grow from an emerging state to maturity it is important that users can make a choice between different service providers, offering a high number of different services and applications to (almost) all end users.

This paper is primarily focused on the end user of broadband services (consumer, enterprise). Many of the arguments are given from the viewpoint of the end user. The main question to be answered is: What are the important conditions to get an open and competitive broadband ICT market with many players offering a variety of broadband services, applications and content and many users enjoying a variety of these services and creating value with the possibilities of broadband?

We believe that the following clusters of conditions are important regarding this question:

- **Access for all**. Can all citizens have access to broadband communication? How to reach e-inclusion? Is the price affordable? Is there an offering available at any place in the country? Is there only one offering or do citizens have a choice between competing offerings? Is the continuity of the broadband access guaranteed at a sufficient level?
- **Trustful and transparent price and quality**. Is service quality at a sufficient and constant level? Do consumers trust providers and the quality of their services? Do they have sufficient privacy protection? Are service quality and prices of broadband services transparent for consumers?
- **Easy switching.** Is it easy to switch from one broadband service provider to another service provider; are there (administrative, technical, economical) thresholds? Do providers use lock-in strategies? Is it possible to reuse customer equipment (CPE) when changing service provider?
- **End-to-end interoperability of services.** Is it easy to communicate end-to-end over the broadband network between consumers who have access by different service and network providers? Are there (administrative, technical, economical) thresholds?

End-to-end interoperability of services is the central theme of this paper. It is often a condition to achieve the other three clusters of conditions as well.

1.2 Definition of interoperability of broadband services

End-to-end interoperability plays a central role in the EU Access Directive for electronic communications [1]. “Operators of public communications networks shall have a right and, when requested by other undertakings so authorized, an obligation to negotiate interconnection with each other for the purpose of providing publicly available electronic communications services, in order to ensure provision and interoperability of services throughout the Community” (Access Directive [1], article 4). “National regulatory authorities shall encourage and where appropriate ensure adequate access and interconnection, and interoperability of services, exercising their responsibility in a way that promotes efficiency, sustainable competition, and gives the maximum benefit to end users” (Access Directive [1], article 5).

In defining broadband one often refers to the capacity of the access network. A distinction between smallband and broadband is then made at 128 kbit/s or at 2 Mbit/s. However we prefer to define the term broadband in a more functional sense as: a broadband network is able to carry multiple services over one network, at least the Triple play services (broadband) internet, telephony and television. A broadband network should further be able to carry several other (future) multimedia applications, relying on an integration of 2 or 3 of the triple play services [8]. The combination of these multiplay services put requirements not only on broadband capacity, but also on e.g. quality of services and security parameters.

We define interoperability of broadband services as the technical, economical and organizational possibility for an end user to use a broadband service end-to-end, due to the possibility of interconnection of access to different networks and service platforms. It should be possible for an end user to communicate to other end users or to use a content service or a remote application while the other end users or services and applications use different broadband access networks and/or different service platforms.

1.3 The Dutch and the European broadband market

The broadband services market in the short term has some characteristics of a national market, with national service and network providers playing dominant roles and with national public-private partnerships playing a stimulating role. An example of such a national market is the Netherlands. The penetration of broadband to households is among the highest in Europe, with an ambition of government and public-private entities to hold this position and make it even stronger [2]. In the longer term the Dutch market will become more European and international. We already see the taking-over of several smaller national broadband providers by larger national and international broadband network providers. Possibly this will happen also with service, application and content providers.

We will give a few examples of how interoperability of broadband services is stimulated and promoted in the Netherlands and which roles are taken by the governments and companies in the private sector to reach this goal.

2 Model of an open broadband market

Different parties play roles in the value web of the broadband market. A schematic presentation of the role model of the broadband market has been made by us in an earlier national project defining the business roles in an evolving Fiber-to-the-Home market [5]. We will re-use the role model in a more general context

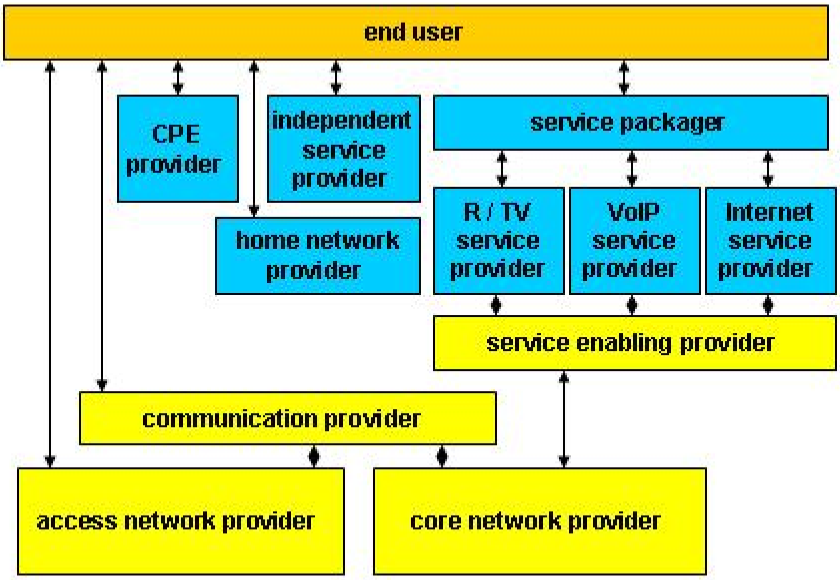

Figure 1: Role model in an open broadband market

The role model is concerned with the offering of broadband services to end users. An end user may have different service providers for each service (e.g. telephony, TV, internet etc). These roles may also be combined in one multiplay service provider role. A service packager may combine the offerings of different service providers in one package and may combine this with the functions of a service enabling provider: authentication, billing, on-line maintenance, customer care and support.

The service providers get the content they use from a content provider. In the entertainment sector, these are providers of movies or games, in the healthcare sector these are parties offering secure access to electronic patient dossiers, etc. Consumers may become content producers themselves. In the future a home network provider may manage the electronic online equipment at home, manage the domotics applications, provide software updates etc.

The core network providers are offering network services in a part of the broadband network architecture. The core network is the central part of the network connecting all the nodes and multiplexing the traffic from many different users. If the Internet Protocol (IP) is used for network routing and if the core networks of different core network providers are interconnected with open access, the resulting cluster of core networks is called the "public internet".

The access network providers give users access to the public internet, to broadcasting TV networks and to switched telephony networks. They manage the access network, the part of the overall architecture between the core network and the home network. They use technologies in the access network like: ADSL, DVB-C, FttH, WiFi etc. If the roles of core network provider and access network provider are integrated, we have a communication provider.

Parties from the Consumer Electronic (CE) industry will offer products like modems, residential gateways, set top boxes, personal video recorders etc. They may do this independent or dependant of service providers and access providers. They may offer their CPE-device suitable for several or just one dedicated access technologies. A commercial provider may also combine two or more roles in one organization.

To conclude this section: end users in an open broadband market may have the choice between different service providers for each service, between service packagers and independent service providers, CPE providers and home network providers, access network providers and communication providers.

If these end users want to communicate with each other and want to use services, applications and content, they expect that these broadband services will be interoperable. Due to the many different combinations of choices, this is not trivial!

For the paragraphs in this paper to follow, we will make a few simplifications in the role model to better clarify the issue of interoperability and to be used in our case. We assume that the end user primarily wants to have freedom in two choices to be made:

1. The consumer wants a free choice for an access network provider (e.g. ADSL, Cable, FttH, fixed wireless). This access network provider has chosen the core network provider, the modem or Residential Gateway for terminating the network at home and even in some cases (a part of) the home network.
2. The consumer wants a free choice for a service provider for each service he wants or for one service provider for a package of services. For example, if he has chosen for his access network an ADSL provider, he wants to have the choice over several internet service providers, several Voice over IP service providers, several TV providers or a service packager. The service provider / packager may have selected certain CPE's for us or may have selected a range of content providers, more or less on an exclusive base.

Using these assumptions, the role model of Figure 1 turns into a more simplified role model already indicated by the color choice in Figure 1 and to be worked out in the next chapter. Interoperability in this simplified role model is still a challenge to be solved.

3 Broadband service interoperability

3.1 A framework for broadband service interoperability

In the preceding paragraph we have given an overview of the different levels of freedom we assume end users demand in a mature broadband market. In the following, we expand on this in a framework for broadband service interoperability.

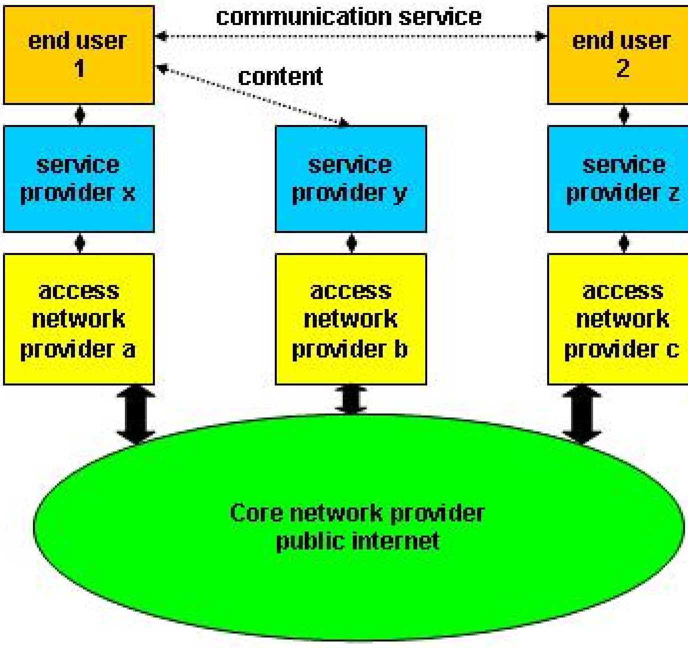

Figure 2: broadband service interoperability at the level of service provider and access network provider

In figure 2 we present 2 different types of broadband service interoperability:

1) Interoperability between different access networks. Here, end users have different access network providers using (in principle) different access network technologies. The users may have their access at different regions so that the service is crossing the public internet and other core networks. They want to use a common service, like for example telephony (voice over IP), online-gaming and peer-to-peer file sharing. The service provider will use a service platform connected to the internet by an access technology or hosted by a computer infrastructure directly connected to the internet (internet exchange).
2) Interoperability between different service providers. With this second type of broadband service interoperability, consumers have different service providers offering the same type of service. Consumers expect the same service level of their communication services for consumers being served by the same service provider and consumers that are catered for by different service providers. In this situation the service providers may have their own service platforms, which should be interoperable. An example is the service Voice over IP (VoIP).

Other types of service interoperability are not further worked out in this paper. Examples are:

3) Interoperability at the sublevel of the physical layer of the access network provider. An example is the unbundled access by different providers to the local loops of copper twisted pairs. Technically and organizationally this is still a challenge in many countries. In the Netherlands since many years this is a task taken by the FIST foundation [4].
4) Interoperability of digital TV service providers; the use of an open standard in conditional access systems of interactive digital television. In the Netherlands this is a point of debate between the ministry of Economic Affairs and the Cable operators.
5) Interoperability of digital home service providers; Use of an open standard in residential (home) gateways. Several home service providers (for example triple play, domotics and multimedia) want to use the same home gateway to get connected to electronic home devices, energy / water meters, surveillance devices and other machines at home. End to end service interoperability across the home gateway is a high challenge currently in progress at the Home Gateway Initiative [9].

3.2 Market forces contra and pro interoperability

We observe the following market and technical barriers in achieving interoperability;

- Vertical integration of service platform and access platform. This may be the case when the service provider and access network provider are affiliated or owned by the same mother company. In some situations both providers use the same service platform, without the possibility of open access between the level intermediate to access network and service platform [6].
- Regional non-interoperability. The broadband service offered in one region cannot be interconnected (with the required quality and speed) to other regions. This may be due to different choices in technology, standards or due to non-standardized solutions.
- Fragmentation. Different choices in optimizing the network (IP) layer. Provider A optimize for service X, while Provider B optimize for service Y. Both providers can offer service X and Y, but the quality of service may be quite different.
- Technical impediments. Some technologies are having impediments regarding some service characteristics.

The barrier on vertical integration is sometimes maintained to give the vertical integrated provider a headstart in the competition with other (non-integrated) providers. The barrier of regional non-interoperability may be solved by connecting the service platform directly to a main internet connection, e.g. near an internet exchange location. Sometimes non-interoperability due to fragmentation and technical impediments is unavoidable for a restricted period of time, because technology is not developed to a mature position.

In the longer run interoperability is often interesting for market parties to get further growth. For an access network provider it is an important advantage if their customers can use as many services and applications as possible with a satisfying quality. For this access provider it is not sufficient to offer only the services of providers affiliated to the same mother company or to offer only one category of services (e.g. only internet services). For the same reason it is not sufficient to offer only the services from service providers in the own region. Thus the access network offering access to *all services and applications with maximum quality, speed and security* is more attractive for end users, giving the access provider a more favorable position in the market.

Access providers will tend to expand the region of operations and the scope of services to be offered because of economy of scale rules! For the service provider we see more or less the same argumentation. Important is also Metcalfe's Law: the value of a service grows by N-squared, with N the number of end users using the same service. With increased interoperability the number N is increased and so the (economic) value of the service for the end user will increase.

As was stated before, national regulatory authorities (NRA) have the possibility to encourage and where appropriate ensure adequate access, interconnection and interoperability [1; article 5].

An alternative to regulation by an NRA is "self-regulation"; private and public parties make an agreement about choices in the network and service platforms in order to get maximum broadband service interoperability. This is good for the end user, but also good for the providers as we have explained above. In the next chapter we will give two cases of self regulation in the area of broadband service interoperability in the Netherlands.

4 Cases of interoperability in the Netherlands

We present two cases of interoperability taskforces in the Netherlands in this paper.

1. Interoperability between different access networks. In the Netherlands the taskforce “E-Norm” is making agreements between network and service providers and their vendors to reach broadband access network interoperability.
2. Interoperability between different service providers. An example is the service Voice over IP (VoIP). In the Netherlands the taskforce “VoIP-technical” is making agreements between VoIP service providers to reach VoIP service interoperability.

4.1 Taskforce E-norm

The goal of the taskforce E-norm is to formulate a reference model broadband for the different broadband access networks. The reference models contain choices and agreements upon standards and architectures. As a result of the harmonization given in this reference model, the upscaling of the broadband market should be advanced.

The history of this taskforce starts with the formation of the “Impulse Committee Broadband” by the minister of Economic Affairs in the first quarter of 2004. The task of this commission was to advise the minister about the conditions to be created by the central Dutch government for the transition to a next generation broadband infrastructure and to a sustainable development of broadband services and applications. The final report of the commission was published in October 2004 [2], with 10 recommendations. One of them is:

A reference model broadband should be formulated, with an institutional framework in a national governance organization broadband. A taskforce E-norm should be formed to formulate the reference model. The taskforce is facilitated by the Dutch standardization authority NEN [3]. The aim is to reach the formal status of a “Dutch Technology Agreement” (Nationale Technologie Afspraak NTA 8022). It is expected that public and private parties will commit themselves to these agreements. The government may stimulate the use of the reference model by asking local public-private and private initiatives for building new broadband infrastructures to have conformity to the reference model in their Request For Quotation (RFQ). The reference model is also useful in the project “Connecting the dots” [11] which aims to connect local broadband infrastructures in order to get a larger scale for locally developed services and applications.

The tasforce E-norm started in April 2005, chaired by Roel Pieper. Players represented in the taskforce are:

- system-integrators and vendors (Philips, Alcatel, Cisco, Lucent, Samsung),
- network operators (KPN, UPC, VECAI, Versatel, Tiscali) and internet exchanges (NDIX)
- service providers (Surfnet, Xs4All, NOB).

- consultants (Stratix, Arcadis) and research organizations (TNO, University of Twente) are represented to give their expertise.
- The taskforce is facilitated by the Dutch standardization authority NEN.

The background is the existence of different access networks, based on different technologies. In the broadband access networks we nowadays see broadband technologies for copper (telephony) lines, coaxial (RTV) cable, wireless terrestrial and satellite and more recently optical fiber to the curb or to the home. Each of these technologies have their advantages and limitations. For the interoperability of services however it is important to harmonize with choices to make in the implementation of these different access networks. The taskforce is aiming to get agreement about these choices. It is not the aim to find agreement about the optimum physical layer; diversity in physical layers (copper, cable, fibre, wireless) is accepted. The agreements should concern the transport / network layers: Ethernet and IP.

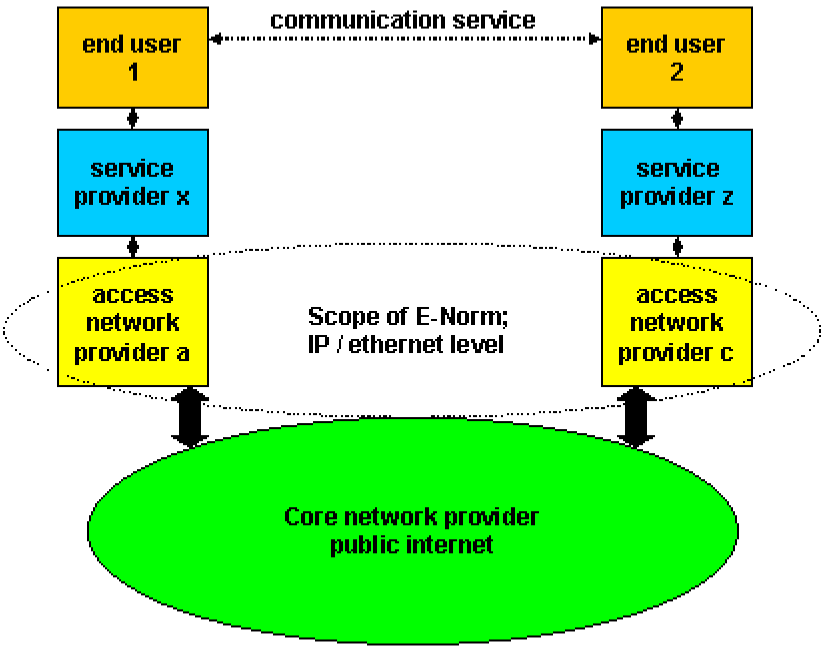

Figure 3: Scope of E-Norm

Two approaches are followed in the taskforce. One approach is using service profiles having an optimum performance of service if some choices on the network layer are made. The second is starting from a 3-dimensional network description to define some network characteristics at interfaces on a geographical level or between different network layers. Within the regional layer or the network layer, an operator is free to make his own choices.TNO is chairing the working group for the service profile approach. This approach takes three steps:

1. Description of service characteristics and the main possibilities
2. Description of distinguished service profiles in terms of service characteristics.

3. Each service characteristic in a service profile leads to preferences for certain choices in the access networks. For some service characteristics we observe impediments in some network technologies. Both the choices as the impediments are formulated in the reference model.

4.2 Some results of taskforce E-norm

This approach has achieved some first results which are presented in table 1-2-3 respectively. The results are just given for illustration. They are not explained in this paper. This may be found on the wiki-page [3].

SERVICE CHARACTERISTIC	POSSIBILITIES	DESCRIPTION OF THE POSSIBILITIES
Capacity	Small	<128 kbps
	Middle	128kbps -10 Mbps
	Super	10Mbps - 1 Gbps
	Ultra	>1 Gbps
Symmetry	Symmetry	Upstream = downstream
	Asymmetry	upstream << downstream
	Downward	upstream very restricted (service control only)
Duplication	Point-point	Between two single end users
	Point-multipoint	From one to many end users
	Multipoint-multipoint	From many to many end users
Quality of Service	Real time	No loss, no latency and jitter.
	Real block time	No loss, low jitter, but latency is allowed
	Best effort	Loss, latency and jitter are allowed; not any guarantee
Security*	Physical level	Dedicated physical medium, no shared physical medium in the network.
	Connectivity level	Traffic separation on OSI-level 2 in the network.
	Authentication	Use of username and password to get access.
	Application / Device	Use of end to end encryption in application or in device.

*) in one case several possibilities may be used at the same time

Table 1: most relevant service characteristics (a summary; see also [3])

SERVICE PROFILE	NETWORK CAPACITY	SYM-METRY	DUPLI-CATION	QUALITY OF SERVICE	SECURITY
Internet	Small / Middle	Asym / down	P-P	Best effort	Authentication
Personal communication	Small / Middle	Sym	P-P	Real time	Connectivity Appl. / Device
Audio Video streaming	Middle / Super	Down / asym	P-P/ P-MP	Real block time	Appl. / Device Authentication
Interactive entertainment	Middle / Super	Asym / Sym	P-MP / MP-MP	Real time	Appl. / Device Authentication
Business applications	Middle / Super	Sym	P-P / MP-MP	Real (block) time	Connectivity Appl. / Device Authentication
Peer-to-peer filesharing	Middle / Super	Sym	P-P	Best effort	Authentication

Table 2: service profiles and service characteristics (a summary; see also [3])

SERVICE PROFILE	FIBRE TO THE HOME	COPPER TWISTED PAIR	CABLE COAX	WIRELESS
Internet	Support of TCP/UDP and IP protocol			
Personal Communication	Support of service **priority on** Ethernet Layer 2 **(802.1p/q)** and or IP Layer 3 **(DSCP)**	Support of priority on ATM layer 2. Or: Support of service **priority on** Ethernet Layer 2 **(802.1p/q)** and or IP Layer 3 **(DSCP)**	***EuroDocsis QoS:*** Support of priority on layer 2. Support of service **priority on** Ethernet Layer 2 **(802.1p/q)** and or IP Layer 3 **(DSCP)** Telephony may use the **"PacketCable"** standard.	***WiFi netwerken:*** Service priority in the future: use of **802.1e** ***WiMAX:*** Support of **"Service flows"** and mapping of **802.1p/q** to "services flows"
Audio-video streaming	Broadcast Audio/Video over IP: support of '**multicast**' in both routers and switches. Some networks may support IP-TV traffic separation using **VLANs (802.1q**.			
	Not over IP: Distribution of (broadcast) Audio/Video via seperate wavelength is possible		Not over IP: Analoge and digital distribution of (broadcast) Audio/Video using separate channels on the cable	

Interactive entertainment	Quality of Services levels similar to personal communication			
Business applications	Support the separation of traffic on Layer 2 Ethernet using Virtual LANs (802.1Q) And on layer 3 allowing proprietary VPN solutions	Support the separation of traffic on Layer 2 ATM using Virtual Channels And on layer 3 allowing proprietary VPN solutions	*EuroDocsis:* Support of traffic seperation. Use of encryption and authentication using the BPI+ function in EuroDocsis. And on layer 3 allowing proprietary VPN solutions	*WiFi netwerken:* Support layer 2 security using WPA and 802.1i And on layer 3 allowing proprietary VPN solutions

Table 3: choices in broadband access networks (a summary; see also [3])

Members of the taskforce have been cooperative to reach a first version of a reference model. Access network providers gave the best and most active support. Service providers were willing to give their experiences with the different access networks they have used. TNO took the role as editor of a concise report. They also could provide some structuring in service characteristics extracted from the national project Freeband B@Home [7]. The results are not fixed and static. They are presented on a “wiki-page” [3] in order to allow all interested parties to give their comments. A moderator is watching and guarding the editing process, in order to get additions of sufficient quality and to preserve a balance in information about competing technologies. The taskforce was originally started as a Dutch national initiative, writing the reference model in Dutch. However it was decided in May 2006 to extend it to all European parties and to translate the reference model in English.

4.3 FIST taskforce “VoIP-technical”

FIST is the Dutch Forum for operators and (internet) service providers concerning interconnection and special access. FIST is a consultative body: every operator and service provider registered with OPTA can become a member. FIST was established in 1996 by the Netherlands Ministry of Transport and Communications [4]. Main objective of FIST is to reach an agreement concerning matters of interconnection and special access. FIST consists of one working group and various taskforces. FIST is facilitated by TNO. Main activities of FIST are: taskforce Main Distribution Frame (MDF), non-geographical numbering, carrier preselect, interconnection services, Voice over IP [4].

The goal of the FIST taskforce “VoIP technical” is to get agreement on technical and operational aspects of the interconnection between the VoIP domains of different network operators. The work of the taskforce is based on general agreement about these aspects. Players in this taskforce are VoIP service providers (e.g. Easynet, Casema, KPN, Priority Telecom). TNO is chairing the taskforce, because of its expertise on this subject and its independent position.

The background is that more than a century the telephony service was based on a common technology which is basically to get a fixed connection with a constant capacity between person A and person B. With voice-over-packet technology this connection is not fixed anymore and the capacity is not constant. Voice is handled as data and data-packets are transported over the network. The control of the Plain Old Telephony Service (POTS) was based on a common signaling protocol, ISUP-SS7. However the signaling in the Voice-over-package world is not the same in the domains of internet (SIP), mobile telephony (IMS), cable telephony (Packet-Cable) and fixed network telephony (ISUP). The common way to make a voice call between two different voice-over-packet domains is to use an intermediate transportation over the fixed TDM network with a gateway for protocol translation. This intermediate transportation however makes the voice call more expensive and prohibits the use of several value added services. This intermediate transportation may be avoided by so called “VoIP peering”. To achieve this, a common basic set of signaling is needed.

4.4 Some results of taskforce VoIP-technical

The cooperation between the VoIP service providers has been successful. The VoIP service providers in this taskforce have made a first set of technical and operational agreements on a voluntary base over the use of the SIP protocol for the wholesale interconnection of VoIP traffic. In this first set only the basic voice service (POTS) is concerned [12].

If a great number of providers adhere to such agreements, these agreements become attractive for other providers to adhere to as well (Metcalf’s law). Providers don’t need to use a gateway VoIP-TDM and a TDM connection (with higher cost) anymore. By direct peering their VoIP traffic, they can save money.

Basic agreements for service interoperability: The basic set of signalling between the internet, mobile, cable and fixed telephony domains is formed by the SIP protocol (Q.1912.5). The SIP-protocol profile B is the minimum requirement for basic voice services. Profile C is fully transparent for TDM signalling. Profile A is focused on mobile use. These SIP protocols are used between the SIP proxi-servers of two providers (wholesale peering). Two diffserv traffic class markings are mandatory (media streams, signalling). CLIP / CLIR is mandatory.

Each provider should give access to the user for the 112 emergency call. This service is still offered in the Netherlands only by KPN using a TDM connection. Providers should switch to the KPN network in case of an emergency call (figure 4). Supplementary services have been discussed and agreements have been made on the interoperability of calling line identification presentation and - restriction.

The use of the national telephone number was agreed, and the reuse of the COIN network for number portability. Different options for interconnect access at the lower network layers were agreed upon (IP, Ethernet, transport protocols and interconnection architectures).

Processes and procedures for testing, fault management, forecasting and billing verification were agreed upon.

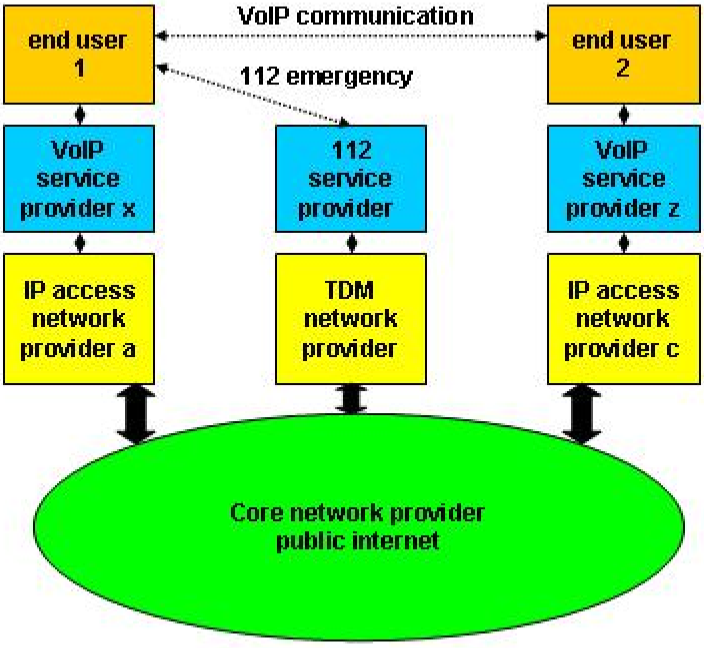

Figure 4: Illustration of the basic agreement for service interoperability for VoIP

5 Conclusions

In this paper we have presented a model for the open broadband market and for broadband service interoperability. We have addressed interoperability issues at two levels: on the access network provider level and the service provider level. More levels of interoperability are possible in theory; however it is not clear if this would be necessary and effective. Interoperability in an emerging market may even hinder innovative and starting companies. However we have argued the importance of interoperability for the end user as well as the provider in a growing and mature market.

In order to illustrate our argument, we have used examples of two case studies in the Netherlands: the E-norm taskforce that deals with interoperability at access network level and the FIST taskforce VoIP-technical, that focuses on voice over IP service interoperability.

The E-norm case has reached a first version of a broadband reference model. It is not clear yet if providers really adhere to all the choices in the reference model. A lot more of communication and active support is needed. An important issue is that choices in E-Norm are currently made on a national level only, while many vendors and operators are acting on an international scale.

The FIST VoIP case has been successful in fast agreement on the SIP-protocol for supporting basic telephony services. Agreement on supplementary services is still a challenge to be achieved.

These two cases illustrate how “self regulation” of providers in growing markets is wanted and effective in achieving broadband service interoperability on a basic level. The case descriptions are also examples of how European / international broadband service interoperability could be developed.

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