

**Competition and Services in Next Generation Networks –
The impact of convergence of services on value chains and markets**

by

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Abstract

Next Generation Networks will lead to significant changes in the telecommunications industry. Customers however are mainly concerned with services and don't care much about the underlying technology. This article examines next generation services from a user's, technical, economical and regulatory point of view. Convergence of services will influence value chains in telecommunications service delivery and align them with service delivery in the Internet. It will be important for regulators to maintain or increase the level of competition during this transitional phase.

Since future services will aggregate elements of communications services (conveyance of signals), information services (processing and storage) and audio-visual media services (content), it will be difficult to maintain different regulatory frameworks for these different services segments.

The main regulatory tasks in this respect are maintenance of the competitive level achieved, promotion of the layered structure of the network and network neutrality.

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1. Introduction

The advent of Next Generation Networks (NGN) in the core and in the access area brings about significant changes to the telecommunications market. The impact of this new technology especially on competition is yet open as there are tendencies strengthening the belief in more infrastructure based competition but also voices which expect re-monopolization¹. Independent from the attempts to secure competition in telecommunications services and applications the public Internet becomes more and more suitable to substitute traditional telecommunications services. Although the telecoms sector continues to be key to the European economy the relationship between the market segments within the market for telecommunications networks and services is changing. Fixed voice continues to decline in terms of volume and revenues, the mobile market is reaching maturity and fixed broadband continues to show strong growth.² Traditional voice services accordingly lose their importance and are increasingly challenged by a plethora of services made possible through innovation in the Internet environment.

The authors have addressed some issues on the ITS conference 2007 in a paper entitled "NGN, IP Interconnection and the Effect on Existing Business Models and Competition in the Telecom Sector".³ Meanwhile a study on the impact of NGN on the business models of carrier selection/value added service market has been conducted.⁴ As one of the main fields of relevance the authors have identified that regulators may find it difficult to maintain the level of competition that has been achieved in the PSTN arena in an NGN environment. This paper offers some further insights. Thereby, section 2 explores the term "service" in fixed and

¹ See Marcus, Elixmann (2008); Reichl, Ruhle (2008); Kirsch, von Hirschhausen (2008) and Amendola, Pupillo (2008) in *Communications & Strategies*, Nr. 69, Q1/2008.

² See European Commission (2008a).

³ See also Reichl, W., Ruhle, E.-O. (2008).

⁴ See "GUTACHTEN zu den technischen und regulatorischen Aspekten von NGN / Voice over IP (VoIP) im Zusammenhang mit der Erbringung von Mehrwertdiensten im Auftrag von FST e.V. und VATM e.V. ("Expert opinion on technical and regulatory aspects of NGN / VoIP with regard to value added services". This document is not in the public domain; please contact authors for more information.)

mobile networks as well as in the Internet world. This is followed in section 3 by a regulatory perspective on the changing definitions and the impact resulting from this. Section 4 focuses on competition and value chains. Especially the issue of service vs. infrastructure based competition will be taken into consideration. This finally leads to considerations and conclusions in section 5 whether NGN will lead to more or less competition.

2. The changing meaning of services and applications in the context of PSTN / ISDN, mobile networks, NGN and the Internet

Services and applications have a different meaning in telecommunications and the IT industry. Although the borders will become blurred it is important to understand the different concepts. This will also provide the basis for discussion of the evolution of regulatory concepts in chapter 3.

2.1 Services provided by PSTN / ISDN / PLMN

Services used to be closely interlinked with telecommunications networks. Indeed the PSTN network was specifically designed to provide the service of voice telephony. The service is therefore an integral part of the network. Service logic implemented in the network and under the control of network operators is the traditional telecommunications paradigm, upon which still much of existing vertically integrated networks and business models are built.⁵

ISDN – the Integrated Services Digital Network – was the first approach to distinguish between transport and services. Additionally to the voice application ISDN offers a 64 kbit/s unrestricted data transmission service. This transparent bit-pipe was, however, mainly used to access a data network – the Internet. In the ISDN network operators still control the service logic and the business models have not changed.

⁵ See DENTON (1999)

In the 1990s the intelligent network characterized the move from decentralized service logic to a centralized system. Service independent building blocks accompanied the trend to modularisation and re-use of software and should have allowed greater flexibility in telecommunications service creation and provision. This potential was only realized to a very limited extent.

Meanwhile, the telecommunications industry has developed the concept of a next generation network, which shall be a common packet based network based on broadband access allowing access to competing service providers.⁶ Although this trend is governed by technological evolution, the crucial point are the business models evolving from it.

In order to understand the term service as used in telecommunications we have to examine the relevant standards, which provide a generic definition. Telecommunication services are divided in two broad categories⁷ (see Figure 1):

- bearer services, which are telecommunication services providing the capability of transmission of signals between access points;
- teleservices, which are telecommunication services providing the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between network operators.

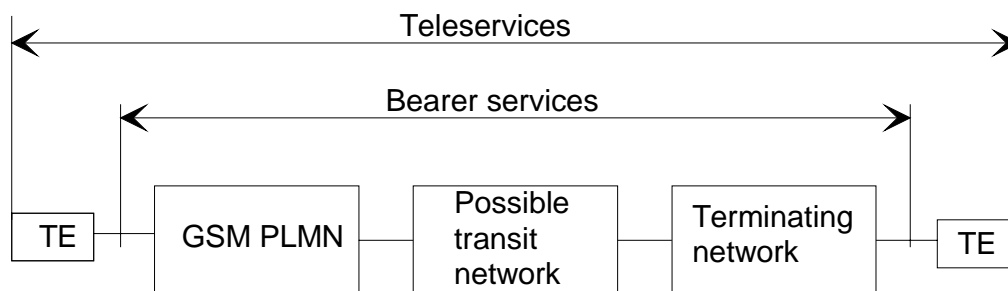


Figure 1: The telecommunications definition of services

⁶ ITU-T (2004)

⁷ See ETSI TS 100 500; although the reference is to mobile networks, the service model is derived from and applicable to fixed networks.

These basic services can be combined with supplementary services. A supplementary service modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a stand alone service. It must be offered together or in association with a basic telecommunication service. The same supplementary service may be applicable to a number of telecommunication services. A typical supplementary service is e.g. call forwarding or call barring.

To make the context clear it has to be noted that this is a technical definition used for the design for telecommunications networks. Regulatory treatment in the definition of “services” is governed by the principle of technological neutrality and might differ from the technical approach. This is also underpinned by the fact that users in general do not care about technology.

The general notion of the term services as used in telecommunications is, that they are provided by an interconnected set of vertically integrated networks. Existing systems have traditionally standardised the complete sets of teleservices, bearer services and supplementary services which they provide. As a consequence, substantial efforts are often required to introduce new services or simply to modify the existing one (customisation). This makes it more difficult for operators to differentiate their services. At the same time however, this may reduce the complexity of providing a service across different operators’ networks.

The standardisation efforts have now shifted to service capabilities⁸. In circumstances where the service is meant to be used across different operators’ networks, hence a common specification set is of paramount importance, the service should be standardised to a level of detail sufficient to ensure interoperability and interworking across different operators’ networks.

The definition of teleservices does hardly take into account a horizontal segmentation neither with respect to technical implementation nor to business models. The trend in telecommunications networks is to increasingly restrict the service offering to bearer services. Today’s open question is, which level of service offering provides a sustainable basis for business

⁸ See ETSI TS 122 101

models. The Internet has demonstrated, that a very basic bearer service (i.e. best effort IP connectivity) provides an excellent basis for innovation in the upper layers. The drawback – as mentioned above – is, that a common set of specifications is of paramount importance in order to achieve interoperability of services.

2.2 Internet Services

In the end of the 1990s e-mail and the World Wide Web have paved the way for the success of the Internet. Broadband services fulfil the demand of ever increasing bandwidth for Internet applications. The technological boundary in the Internet is the IP protocol. IP connectivity can be considered a bearer service and in future it might be the only bearer service required.

What are the predominant and successful services in an Internet environment? This is a widely explored question and the short introduction here can only show a snapshot:

- The basis for service creation in the Internet is the distinction between network functions and edge functions. Saltzer, Reed and Clark⁹ coined the term “end-to-end argument”: “Functions placed at low levels of a system may be redundant or of little value when compared with the cost of providing them at that low level.” This means that functions move to the edge of the network, where change and innovation are much easier than within the network. The Internet is in principle only concerned with the routing of packets to their respective IP-addresses. The internet protocol represents the border line between Internet Service Providers (ISPs) and applications. Although the border becomes blurred¹⁰, it is still visible in technology and business models.

⁹ See Saltzer, J.H.; Reed, D.P.; Clark, D.D. (1984) and ietf (1996)

¹⁰ See Clark (2002)

- Upon this Internet highway¹¹ different services have developed. Two important ones are e-mail and the World Wide Web. E-mail is based on a common protocol and the wide availability of clients (dominated by Microsoft Outlook). The World Wide Web is also based on a commonly adopted protocol http and the availability of web browsers.
- Social networking services are gaining importance. These services in general serve to bring people together and facilitate collaboration and new forms of networking. Examples are applications like Facebook¹², MySpace¹³ or Cyworld¹⁴. Danah M. Boyd¹⁵ has attempted to define social networking services as:

... web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site.

Wayfinding is an important service in the Internet. Google is today's best known example of a search engine, which enables orientation in the World Wide Web. On the other hand, for Google the large number of searches build a valuable data base, which can be exploited for advertising and market research.¹⁶

The basic bearer service in the Internet environment is connectivity. The ISPs offer the connectivity to all public internet addresses and additionally a translation service for URIs into IP addresses. A user is still able to establish a connection by using only the IP address of the other party, although most of the communication is done via URIs and translation in the DNS (domain name system). As in the PSTN/ISDN, no ISP is in the position to offer the connec-

¹¹ This analogy is often used, as transport and communications develop similar behaviour (see various publications by Andrew Odlyzko – <http://www.dtc.umn.edu/~odlyzko/doc/recent.html>)

¹² <http://www.facebook.com>

¹³ <http://www.myspace.com>

¹⁴ <http://www.cyworld.com> is a popular Korean social networking site. It has also been launched in the US in 2006 (<http://us.cyworld.com>)

¹⁵ see BOYD, D.M. & Ellison, N. B. (2007) also for a timeline of social networking sites

¹⁶ see BATTELLE (2005)

tivity service on its own. The prerequisite is interconnection on IP level (via peering or transit service). There is no QoS, which means the service is best effort, although in many cases “good enough”.

There are many services on-top of basic IP connectivity. These services tap into delivery channels of other industries and offer more efficient ways for communications and information exchange. Affected industries are

- Broadcasting – BBC has started to offer the iPlayer service¹⁷. BBC television¹⁸ and radio programmes are available on the Internet for 7 days after they have been broadcasted.
- Sales – E-bay is in a much better position to bring supply and demand together than small shops or even large chains. Google is a much better way to identify a suitable supplier than the yellow pages.
- Advertising – Traditional advertising can never be as specifically tailored to the target audience as Google can do it. Google can easily put together information provided by the user and introduce ads very specifically.
- Telecommunications – Skype shows that the application of voice telephony does not require specific networks. The drawback is that Skype is closed in the sense that it provides no open protocol and no interworking with other VoIP applications.
- Music labels – Digital distribution will play a massive and expanding role in the music industry and complement or replace sales of compact disks.
- Creation of content – Is there still a business model for multi-million dollar movies, when content creation can also be done by the users. In January 2008 alone, nearly 79 million users watched over 3 billion videos on YouTube.¹⁹

¹⁷ <http://www.bbc.co.uk/iplayer/>

¹⁸ Television programmes are only available in the UK. BBC examines the IP address and relates to the geographical location of the Internet user.

- Publishing – More and more publishers explore the Internet as a distribution channel. Publishing has also become easier. Bloggers can economically target a small audience and express themselves to the public.

As we will explore in chapter 4.1 the value chain in Internet services is different from telecommunications networks. The model of vertical integration has given way to a layered and modularized approach not only in technology but also in business models.

2.3 The mobile phone as a service platform

Mobile phones become platforms for applications. Telephony will be just one service amongst many others like mobile TV, mobile games, ringtones and ringbacktones, wallpaper, mobile search, mobile social networking, mobile advertising and mobile payment²⁰. Between 20 and 25 % of all operator revenues are generated by data services, and 90 % of all data revenues are SMS. Mobile broadband is a main trend and Apple's iPhone is the mobile industry's most vivid demonstration that multimedia convergence is a two-way street. It has given telecoms firms the opportunity to expand into the consumer electronics and entertainment space. But, more importantly, it offers leading 'internet' and consumer electronics goods companies the chance to expand into the relatively ordered and cosseted world of mobile communications.²¹ Traditional voice telephony has maintained a higher significance in the mobile market than in the fixed market, the trend however is toward data services and applications and voice might eventually become embedded in a multitude of applications.

The value chain in mobile phones is still largely integrated. There are trends to offer open application environments on mobile platforms as for PCs. These platforms represent personal computers and allow the access to bearer services provided by the network. Together with a computing environment they can be used to build complete and innovative applications. The question is who controls this application environment. We observe trends to open

¹⁹ Seeking truth on YouTube (19. April 2008) – <http://www.baltimoresun.com/news/opinion/editorial/bal-ed.notebook19apr19001518,0,3295327.story>

²⁰ See Netsize (2008).

²¹ See Netsize (2007).

this environment up in the same way personal computers and standard software have provided together with IP connectivity a fertile ground for innovation and investment in the Internet. Besides mobile phones which use the Linux operating system two examples for the trend towards open platforms shall be mentioned here:

- The open handset Alliance has been formed in late 2007²². This alliance is committed to greater openness in the mobile ecosystem. Increased openness will enable everyone in the industry to innovate more rapidly and respond better to consumers' demands. The first joint project of the new Alliance is Android™. Android was built up from the ground with the explicit goal to be the first open, complete, and free platform created specifically for mobile devices.
- Marty Cooper is considered the inventor of the first portable handset and was the first person to make a call on a portable cellphone in 1973, that's why FIC's new phone is called Neo1973. The Neo1973 is the first phone designed to run OpenMoko, the World's First Integrated Open Source Mobile Communications Platform. "For the first time, the mobile ecosystem will be as open as the PC, and mobile applications equally as diverse and more easily accessible." said Sean Moss-Pultz, architect of OpenMoko and Product Manager of FIC's Mobile Communication Business Unit. "Ringtones are already a multi-billion dollar market. We think downloading mobile applications on an open platform will be even bigger."²³

A mobile development platform can do much more as a mobile PC and also much more than a phone. If companies succeed in developing a similar environment as PCs and the Internet, a personal mobile device might become the centre of ubiquitous computing.

From the classification of telecommunications services described in section 2.1 we observe a shift to IP bearer services. Services based upon IP bearer can resemble all other teleser-

²² <http://www.openhandsetalliance.com/>

²³ www.openmoko.com

vices as well and might do so in the future. Here also the question remains, who will control the different steps in the value chain.

As described in this chapter we can observe a similar trend in the mobile networks as in fixed telephony. Vertical integrated service offers (i.e. tele services) give way to connectivity services (i.e. bearer services). The industry from a technological point of view is being transformed into a horizontal layered and modularized structure. The trend is further advanced in the fixed market but also clearly visible in the mobile market. Business models will follow and also become more fragmented. For the evolution of the regulatory framework it is necessary to observe this transition and to adapt the rules accordingly.

2.4 Service delivery platform in a Next Generation Network

Traditional circuit switched telecommunications networks are in the process of transformation into Next Generation Networks. ITU expects that in OECD countries fixed NGN will be in place by 2012 and mobile NGN by 2020. This would enable the full and true convergence of fixed and mobile services, voice and data services, and the ICT and broadcasting sectors.²⁴

Today's predominant telecommunications service is still voice telephony – according to ITU statistics data responsible for more than 70 % of revenue in telecommunications, although fixed and mobile data services experience significant revenue growth.²⁵ Services in NGN will look very differently to the voice telephony services we are used to today. The service creation in an NGN will resemble services and applications provided by an IT platform. In this respect we observe similarities between Internet applications and the NGN architecture. A point where these concepts differ is the service logic. In traditional telecommunications networks service logic is located in the software of exchanges. The concept of intelligent networks was introduced in the 1990s to split session control, which remained in the exchanges, from service logic, which was moved to centralized servers (i.e. service control points). This service logic is being accessed from the circuit switched part of the telecommunications net-

²⁴ ITU (2007), page 41

²⁵ Kelly (2007)

work. Mobile networks extended this concept to packet based networks. A main step in the evolution of GSM standards was the addition of a packet-switched domain in the core network. This domain is now used to facilitate access to the public internet from mobile phones. Access has also been developed towards UMTS, which allows higher bandwidth for mobile phone users.

There was, however, no such thing as a service framework for the packet switched domain. The standardisation bodies addressed this “missing link” by standardising the IP multimedia subsystem (IMS). IMS is a global, access-independent and standard-based IP connectivity and service control architecture that enables various types of multimedia services to end-users using common internet based protocols.²⁶ IMS has been adopted by the fixed network operators and extended by access via xDSL lines.²⁷ In the summer of 2007 it has been decided to merge both standardisation groups into 3GPP and pursue further standardisation of the core IMS for mobile and fixed networks together.

IMS being a service control architecture does not define services, it relies on application servers to do that. It has been recognized that in addition to IMS an equivalent to web services is needed, the Service Delivery Platform. The term Service Delivery Platform (SDP) refers to a recently embraced architectural style applied to telecommunications infrastructure problems. It is intended to enable rapid development and deployment of new converged multimedia services, from basic POTS phone services to complex audio/video conferencing for multiplayer games²⁸. Figure 2 shows the structure of a future Next Generation Network including IMS and SDP on top.²⁹

²⁶ See Poikselkä (2006)

²⁷ See the work of ETSI TISPAN with respect to NGN – <http://www.etsi.org/tispan/>

²⁸ http://en.wikipedia.org/wiki/Service_Delivery_Platform

²⁹ See also ETP (2006)

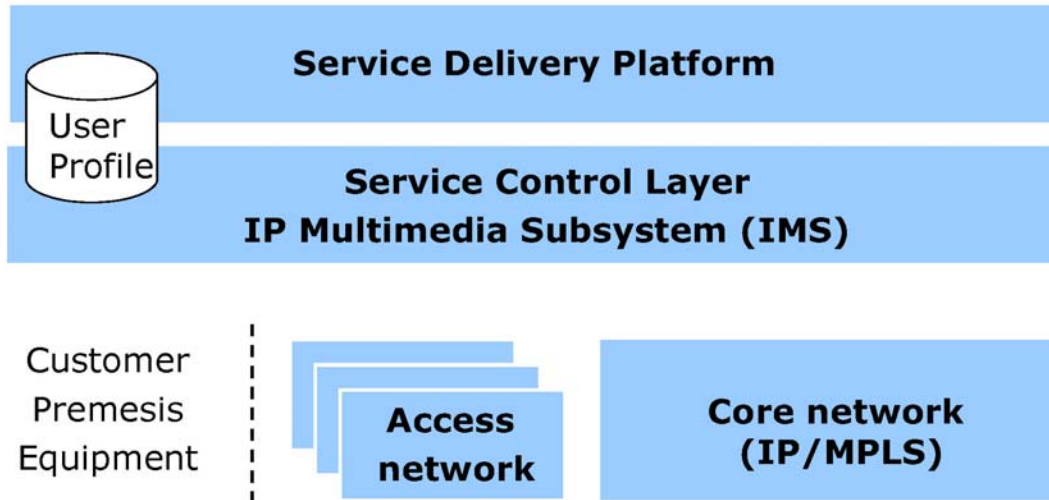


Figure 2: Structure of a Next Generation Network

IMS and SDP do have the potential to transform the telecommunications business, as stated in the Telco 2.0 blog:

“SDPs can be used to support two different business models: a product business (legacy voice and messaging aligned to new internally-driven product innovation), or a service business. A few operators like BT and TeliaSonera are taking the platform approach very seriously and are re-structuring to support it as a business. The critical word is “service”. A true service delivery platform differentiates itself from a mere application server running a bunch of telco APIs. It does this by supporting the full life cycle of the user service - most notably the provisioning and payment for connectivity or content delivery as part of the user proposition.”³⁰

³⁰ Telco 2.0 blog 14 September 2007: http://www.telco2.net/blog/2007/09/putting_the_service_into_servi.html

2.5 Services expected from a Next Generation Network

Let us explore what services are already available and what might be in store for tomorrow:³¹

- Mobile phones increasingly include GPS receivers and a compass. You can now point a mobile phone to a restaurant and ask for customer reviews. Your location data will be transmitted to the service provider and brought into context with a database of restaurant reviews. The results are shown on the screen of your mobile phone.³²
- We will soon be able to pay coffee with our mobile phones by inserting a microSD flash card in the mobile phone.³³ The enabling technology is a new wireless solution called NFC (Near Field Communication). The NFC chip encrypts the credit card information using short distance radio waves that transmit the data directly to the register.
- Your telecommunications provider offers IPTV over your broadband connection and a set-top box (STB) programmed with software that can handle viewer requests to access to many available media sources. IPTV is a platform for many more interactive services accessible via your TV screen. These include gaming, interactive TV, eHealth, community services, eGovernment and many more.
- Mike is exploring a virtual world and meets his good friend Jane, whose avatar he recognizes. He would like to talk to her privately and sets up a phone call without abandoning his online game. During the phone conversation he sends her some pictures of his last holiday. They say good bye and Mike continues playing.
- You are enquiring a specific topic via your NGN connection. The agent offers a short introductory video for a moderate price and you decide to watch the video. You pay via your telecom invoice.

³¹ The first three services exist today; the last two are examples, which should be possible in an NGN environment.

³² The service has been launched in Japan in May 2007; see www.geovector.com.

³³ <http://www.mavromatic.com/archives/000561>.

2.6 Conclusion

Services and applications are not easy to define in a converged ICT environment. We have shown the evolution of services in the telecommunications environment from teleservices to service enablers in the PSTN/ISDN and mobile networks. IP connectivity is a bearer service offered by ISPs and also in the packet switched domain of mobile services.

It remains to be seen how service creation will evolve. We observe the following trends:

- The most important bearer service is IP connectivity.
- Business models are continuously realigned with technological boundaries.
- The mobile phone becomes a mobile platform. Open operating systems will allow a fertile ground for innovation and investment in mobile software.
- Although the telecommunications industry tries to maintain a share of the service market (indeed it has a large share), predictions are that the service market will be taken over by other players.
- It remains to be seen if telecommunications network providers can build a competitive service delivery and creation environment as in the Internet.

It will not be possible to distinguish between services provided by an NGN from services provided by the public Internet. The distinction will be in the business model and in the user's ability to choose between different services. As long as this competitive environment can be maintained, the NGN and the Internet will compete for the most efficient market oriented solution for new services.

Whereas the technical and commercial effects of these developments on the market will be significant (as e.g. market players have to adapt to new technologies with their business models as well as the traditional borders between telecommunications, content and media blur), there is also a regulatory impact. "Markets" in a regulatory perspective and definition change massively and the traditional definition and analysis of markets may become inappropriate for the future challenges (for an analysis see chapter 4).

3. Communications services in regulatory context

The current market structure has its root in the process of a liberalization which started in the 1990s. For the first years after the market opening competition centred on voice communications. The term “telecommunications service” was defined in the ONP framework directive of the 1998 framework³⁴ as:

“... services the provision of which consists wholly or partly in the transmission and routing of signals on telecommunications networks, with the exception of radio and television broadcasting.”

The 1998 framework was refined in 2002. As the European Commission pointed out, technological convergence had to lead to a changing definition of services.

“In the Information Society, the boundaries between telephone, internet, television broadcast and mobile phone services are becoming blurred, even irrelevant. Indeed, frontiers between Member States have also lost much of their significance when it comes to these services. The regulatory approach to the different services has also had to converge. In 2002, the European Union adopted a new regulatory framework for electronic communications networks and services, covering all forms of fixed and wireless telecoms, data transmission and broadcasting. The regulation of the content carried by such services is, however, dealt with under separate rules.”³⁵

The 2002 framework directive³⁶ in article 2(c) defines electronic communications services:

“electronic communications service”. means a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission services in networks used for broadcasting, but exclude services providing, or exercising editorial control over, content transmitted using electronic communications networks and services; it does not include information society services, as defined in Article 1 of Directive 98/34/EC, which do not consist wholly or mainly in the conveyance of signals on electronic communications networks;

³⁴ See European Commission (1998)

³⁵ http://ec.europa.eu/information_society/policy/ecomms/current/index_en.htm

³⁶ European Commission (2002)

Looking closely at the definition not much has changed. The decisive point is still “wholly or mainly conveyance of signals”. These definitions have to be regarded in the context of electronic communications networks³⁷ and public communications network³⁸. The creation of these definitions is governed by the principle of technological neutrality. This means for services that from a regulatory point of view it doesn’t matter which technology is used (e.g. circuit switched telephony or VoIP).

Electronic communications services have to be distinguished from “information society services”. These are services within the meaning of Article 1(2) of Directive 98/34/EC as amended by Directive 98/48/EC:

*“service”: any Information Society service, that is to say, any service normally provided for remuneration, at a distance, by electronic means and at the individual request of a recipient of services.*³⁹

The decisive factor for the distinction between electronic communications services and information society services are the electronic means (including processing and storage).

The third category of services deals with content. These are governed by the Audiovisual Media Services Directive⁴⁰. Audiovisual media services are defined as:

“audiovisual media service” means: — a service as defined by Articles 49 and 50 of the Treaty which is under the editorial responsibility of a media service provider and the principal purpose of which is the provision of programmes in order to inform, entertain or educate, to the general public by electronic communications networks within the meaning of Article 2(a) of Directive 2002/21/EC. Such an audiovisual media service is

³⁷ European Commission (2002): “... transmission systems and, where applicable, switching or routing equipment and other resources which permit the conveyance of signals by wire, by radio, by optical or by other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including Internet) and mobile terrestrial networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable television networks, irrespective of the type of information conveyed;”

³⁸ European Commission (2002): “...an electronic communications network used wholly or mainly for the provision of publicly available electronic communications services;

³⁹ Voice telephony service are not information society services, since they are not provided via electronic processing/inventory systems.

⁴⁰ European Commission (2007a)

either a television broadcast ... or an on-demand audiovisual media service ..., and/or audiovisual commercial communication”

Summarizing the different service terms used by the European Commission we observe a distinction between

- conveyance of signals vs. processing,
- at the individual request of a user vs. broadcast and
- content provided by a media service provider broadcast or on-demand.

Future services might include all of these elements and in some cases already do today. The term service in a general sense can be understood as an access to one or more capabilities via a prescribed interface irrespective of the supply or ownership of the technological basis (network). Service users can be humans or machines. Services can build a complex framework, where individual components might be distributed and accessed via telecommunications networks. The increasing interrelationship of “classical” telecommunications services and services from the content environment poses big challenges to the design of the regulatory framework – on the EU level but also on the national level as broadcasting and content usually is governed by a specific set of rules and provisions.

Value chains in the delivery of services can become quite complex. Every time services are broken down into modules or building blocks there arise problems of architecture and interfaces. These are necessary prerequisites for an efficient functioning of the corresponding business models.

Services converge and the customer doesn't care if services are provided by Internet companies like Google or traditional telecommunications networks and service providers. The user also doesn't care if the value chain is fragmented and consists of many parts or services are delivered by a vertical integrated carrier as his expectation is the end-to-end service/product irrespective of the underlying process of providing the service.

The market evolution exerts further pressure on the regulatory framework to adapt definitions and concepts and abandon the clear delineation between conveyance of signals, processing and delivery of content. This distinction will be impossible to maintain, as services today and more so in the future will not adhere to artificial boundaries, which are overtaken by technological reality.

The European Commission has recognized this challenge and addressed it in the i2010 strategy:

“the i2010 strategy, launched on 1 June 2005, was the first coherent policy framework for the era of convergent telecommunication and media services. Much progress has been made in the past three years. A few examples suffice to show the breadth of achievements: a new regulatory framework for audiovisual media services is in place; proposals to reform the regulation of electronic communications have been launched; regulation to create a single market for mobile phone use across borders is in operation; initiatives to boost online content in Europe are under discussion; major new R&D and innovation funding initiatives are up and running (the Seventh Research Framework and the ICT Policy Support Programme under the Competitiveness and Innovation Programme — CIP); ground-breaking public private partnerships (Joint Technology Initiatives) have just been launched; and new eInclusion initiatives are on track.”⁴¹

As has been shown, the evolution of the regulatory framework is far from finished (on the contrary – it has only just begun).

4. Competition in an NGN and in an IP environment

We have discussed services from a technological point of view and we have clearly recognised convergence. It will become more and more difficult to distinguish between electronic communications services and services for the information society. Content might also be part of future services in an NGN or IP environment.

⁴¹ European Commission (2008b)

In this chapter we would like to focus on the underlying business models and on the regulatory situation, which are interlinked. We will show that convergence from a technological point of view leads to a common converged market, where market players face competitors from markets previously distinct. We will further show that technical interfaces like IP in a horizontally layered structure also lead to a fragmentation in the value chain⁴².

4.1 Value chains in telecommunications and the Internet

We observe different value chains in telecommunications and web applications. In telecommunications evolution has started from vertically integrated companies delivering access and services. Competition in basic voice communications services has been introduced by means of carrier selection. This is called service-based competition, because the entrant uses the services (i.e. voice origination) of the incumbent and enters the value chain on a relatively “low” level, i.e. uses a significant amount of infrastructure of the incumbent. When the entrant builds its own facilities, competition is called infrastructure based. Although service-based competition has lower barriers of entry, sustainable long-term competition is expected to be based on infrastructure⁴³. The more elements of the value chain are supplied by the new entrant, the larger the share that can be described as “infrastructure-based” competition, e.g. in the case of unbundling the entrant parallel to using the incumbent’s access lines also establishes his own infrastructure. Therefore, there is no clear-cut separation between service based and infrastructure based competition. Martin Cave has developed the theory of the ladder of investment⁴⁴, which means that new entrants will gradually invest and climb higher rungs of the ladder. Reality however has not proven this assumption. Also, assessments of what is service and what is infrastructure based may change over time. In recent times one can experience that e.g. business models relying on bitstream access which previously were looked at rather as infrastructure based now are being evaluated as rather

⁴² See Marcus, Elixmann (2008); Reichl, Ruhle (2008); Kirsch, von Hirschhausen (2008) and Amendola, Pupillo (2008) in *Communications & Strategies*, No. 69, Q1/2008

⁴³ See Ruhle, Kittl, Lundborg (2006) and De Bijl (2005), page 12.

⁴⁴ See e.g. Cave, M. (2004)

service based. The increasing amount of infrastructure, especially fibre rollout, may have contributed to this.

We can also observe competition in the offering of value added services. This is the area where content providers can use the telecommunication network as delivery chain. The following charts (Figure 3) were drawn up for the study on value added services⁴⁵ and show the value chain for basic voice communications services and for value added services.

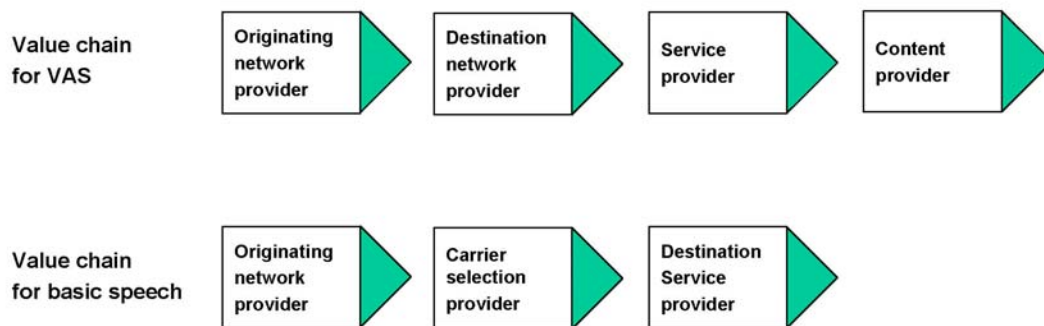


Figure 3: Value chain in telecommunications

Competition in web services and applications is based on the separation between access and services by means of the Internet Protocol. Martin Fransman has drawn a picture of the layers in the info-communications industry (see Figure 4)⁴⁶. In the service layer he distinguishes between connectivity, navigation and middleware and the application layer. It can be clearly seen that traditional telecommunications companies do not play any significant role above the connectivity layer.

⁴⁵ See footnote 4

⁴⁶ Freely adapted from Fransman (2003)

Layer	Activity	Representative companies
Customer		
Applications layer	Contents packaging, web design, on-line information services, broadcasting.	Bloomberg, Reuters, AOL Time Warner
Navigation and middleware layer	Browsers, portals, search engines, electronic payment, advertising	Yahoo, Google, Netscape
Connectivity layer	Internet access and Web hosting	ISPs
IP Interface		
Network layer	Optical fibre, DSL, radio access, Ethernet	AT&T, BT, Colt, T-COM
Equipment and software layer	Switches, transmission, equipment, routers, servers and CPE.	Nortel, Alcatel-Lucent, CISCO, NSN

Figure 4: Layers in the info-communications industry

Competition in services and applications is working in the public Internet, as any user is able to access or distribute lawful content or run any lawful applications and services of their choice. In the Internet there is a clear distinction in the roles of providing access to the network and provision of services. It can be argued that this distinction is the reason for the success of internet based applications and business models. If this is the case, should this separation be introduced into the telecommunications sector as well? And if, how shall this be done?

In an NGN, services will no longer look like traditional voice communications or like value added services. These new services, as described in chapter 2.5, do rather resemble services respectively applications in an Internet environment.

Value chains in an NGN are still subject to speculation:

- Telcos might become restricted to delivering connectivity and might extend their business horizontally to become converged broadband service providers delivering connectivity via fixed and mobile technologies in many different geographical regions.⁴⁷
- Vertical interfaces might develop between infrastructure and core components. Although from the specifications it is possible to split core network, call control (IMS) and applications⁴⁸ there will be economical incentives to not open up these interfaces.
- The possibility to connect third party application service providers was already available in the intelligent network architecture, although it was rarely realized. A noteworthy example of a telecoms operator to provide a platform for service developers is iMode (provided by NTT, Japan). During the last years also European providers (BT, Orange and T-COM) have published APIs to their telecommunications networks⁴⁹. For developers the problem remains that they can only address customers of one network, while in the Internet applications are open for all.
- Since investment in next generation access networks is huge and might lead to sunk cost, there exists considerable doubt that the market will provide these preferably fibre based networks on their own. Worldwide different approaches like PPP or government funded projects arise to fill this gap.⁵⁰
- Business models in NGN will likely be different from business models in the PSTN/ISDN. If consumers are able to access services from competing service providers, as the basic concept of NGN requires (see ITU 2004), there will be no need for an obligation for call

⁴⁷ See FESTRAETS, BOLANDE, WHITE (2008)

⁴⁸ See RTR (2007)

⁴⁹ T-COM: www.developer.telekom.de; BT wholesale : <http://web21c.bt.com/>;
Orange: http://www.orangepartner.com/site/enuk/develop/p_develop.jsp;

⁵⁰ See Aurora (2006); New Zealand Institute (2007); IDA (2006); LEHR, SIRBU, GILLET (2005); OECD (2008) and OFCOM (2008)

origination in order to enable carrier selection⁵¹. However as the expert opinion on carrier selection and value added services⁵² shows, the removal of the obligation of carrier selection and preselection will endanger existing business models. Therefore a careful balance needs to be struck between addressing technological evolution and preservation of competition. This will most likely result in sufficiently long transition times.

From the technological evolution we can derive that voice telephony is nothing special. An all-purpose data network can be used for any kind of application, be it delivering of files or voice communication. Concerning the business there is no doubt that companies like eBay, Google or Microsoft are able to develop a worldwide telephony application. However, voice telephony is still special – governed by sector specific regulation. We face the situation that two different regimes are dealing with the same issue, which will lead to numerous arbitrage opportunities and confusion and will shake-up the telecommunications industry as well as the software industry. The regulator's task is – as society's role ever was – to, first introduce and after that, safeguard competition and protect consumer interest. It is not the regulator's task to pick winners or to influence the game.

These two different regimes (or three – if broadcasting is also considered) have evolved historically. The principle of regulatory certainty makes it difficult to change these regimes as quickly as technology demands. Therefore a balance between regulatory certainty and adaptation of the rules has to be struck. If rules had been technology neutral there wouldn't have been a problem. However we conclude that there is a principle limit to technology neutrality. It is merely impossible to foresee impacts on society of a technology, which doesn't exist yet. Business models and technologies once introduced by regulation always have a certainty to receive more attention and focus of the regulator also in the future – owing to the investment intensive character of network industries.

⁵¹ See BnetzA (2008)

⁵² See footnote 4

4.2 Infrastructure based competition / service based competition

Technological advances have made it possible to introduce competition in telecommunications. Regulation was needed in the transition phase with the intention to be withdrawn as the market develops and to be replaced by competition law. Competition law, applied in case of market failure only should be sufficient and sector specific regulation can remain only in cases where enduring bottlenecks are identified.

The opinion is still maintained by many, that infrastructure based competition delivers more favourable results than service based competition. The authors of this article would like to point out a different angle.

The notion of service- and infrastructure-based competition makes the implicit assumption, that a vertical integrated business model is still the best way and the market will allow the economic development of parallel vertical integrated models. What it does neglect is a horizontally layered structure. If e.g. the distinction between transport and services is universally accepted in technical terms and business models, the concept of service- and infrastructure based competition needs to be looked at in a new way. Market players in the service area are not concerned that competition is service based, because the underlying service (IP connectivity) is freely available and represents no bottleneck. Concluding the authors would like to state that service- and infrastructure based competition are ways to overcome the bottleneck character of the access network. A ubiquitous bearer service like IP connectivity separates infrastructure from services and restricts the problem of competition to the lower layers. In this context it is understandable that unbundled local loop (ULL) has been regarded as facilities-based competition, since all layers are in the control of the new entrant, on the other hand it can be understood as service based, because the new entrant uses services from the incumbent. If access constitutes an enduring bottleneck, competition can be established in the higher layers⁵³.

⁵³ See New Zealand Institute (2008)

In the market we observe various trends:

- The value chain in telecommunications becomes fragmented and different players emerge in niche markets. These players do not necessarily strive for a vertically integrated business model.
- Players do not necessarily move up the ladder of investment. They are sometimes content to exploit niche markets opened up by regulatory intervention like regulated prices for wholesale products.
- Broadband technology offers the possibility to distinguish between transport and services. Hence the fragmentation of the telecommunications market is an unavoidable result.

When the entrant uses the facilities of the incumbent to a large extent, competition is called service-based and can be realized either through resale or through unbundling schemes. When the entrant builds its own facility, competition is called facility-based.

Marc Bourreau and Pinar Dogan write⁵⁴:

For the full functioning of competition, it is necessary that each operator control its supply chain to the largest possible extent. Facility-based competition is perceived as a necessary condition for long-term efficiency. This is because the benefits from flexibility and innovation obtainable under this state of affairs exceed by far those achievable under facility-sharing settlements. Under facility-sharing agreements, the entrants rely on the ILECs' network for providing services, and hence, are restricted by the ILECs' choices of price, service and technologies. Woroch (2002) points this out as a limitation of service-based competition, and argues that service-based competition at best, over the long run, is a stepping stone to facility-based competition.

It is implied that service based competition in telecommunications might serve as an intermediate step to full facility based competition. The authors would like to argue that service based competition could be a normal way of market development. In an Internet based envi-

⁵⁴ See Marc Bourreau and Pinar Dogan: "Service-based vs. Facility-based Competition in Local Access Networks", 11. June 2003

ronment we have service based competition, if we define IP connectivity as wholesale service. This basic wholesale service is being offered by ISPs. Customers pay for internet access according to bandwidth and volume. The service they get is a basic connectivity to all public Internet addresses. The ISP does not determine nor restrict what kind of services are being offered resp. used by the consumer. The network is service agnostic as are the interconnection agreements between different ISPs. In this environment IP serves as a strict technical and economical boundary between business models.⁵⁵

We observe different players in the connectivity area and in the service area. The services/applications are in general dominated by IT firms and content providers. In the area above the IP layer different service models are being developed by the market. Competition in the Internet is thus “service based”. Why does the telecom industry regard service-based competition as an interim solution? This leads us to conclude that the distinction in service and infrastructure based types of competition, e.g. by allocation ULL to infrastructure based and resale to service based competition applies to the traditional technological environment. In today’s NGN and NGA environment, such a view needs to be revised as described above as the infrastructure is clearly separated from the services and the existence of one capable infrastructure may lead to less competition on the infrastructure level but more competition on the service level. Also, this type of service based competition as it needs to be understood today reaches further than in the past and therefore is not a terminological contraction to the terms prior to the NGN/NGA developments.

4.3 Case study: Carrier selection and value added services in an NGN in the German market

The authors – in cooperation with further colleagues from JUCONOMY and ÖFEG – have just completed a study in Germany on the question how the provision of value added ser-

⁵⁵ This is also the context for the ongoing discussion about network neutrality. The scenario described here is the predicted outcome, if competition is working. The European Commission has introduced the possibility to intervene if the market fails to provide a suitable level of QoS (see European Commission (2007b) and chapter 5.2).

vices can be maintained in a changing environment. Major findings from that expert opinion are presented as a case study here.

Germany is a market with a very strong role of carrier selection operators and the provisions of especially value added services by alternative providers, whereby the business models are very differentiated and each element of the value chain (access providers, carrier selection provider, platform provider, content provider) has a specific role. The study researched how the achievements from service competition in PSTN could be maintained and secured in an NGN environment. The main results with respect to regulatory requirements and the design of the framework were:

- The regulatory principle of technological neutrality is put to a test. If we regard NGNs as new technology, regulators must not favour operators who use one or the other technology.
- In Germany the role of carrier selection operators in a VoIP environment is questioned by the BNetzA as an expert group report published in 2006 did not see the need to continuously foresee the wholesale (interconnection) service for call origination. This is a potential threat for competition.
- The costs for migration to an NGN environment must be distributed evenly according to the principle of cost causation. Market players must not be allowed to impose costs on competitors by changing interconnection of networks (neither location, number, layers or technical equipment) if this serves only to optimize their own network and other operators are dependent on wholesale services and thus on the network structure of the other operator.
- Identification, accountability, end-to-end quality of service and consumer protection as well as data protection issues need to be agreed for an NGN environment. The main guiding principle being that no degradation must be allowed.
- Value added services constitute an important market in Germany and allow competition in telecommunications services beyond the conveyance of calls. Value added services are delivered today in conjunction with carrier selection services. By questioning the future

role of carrier selection in a VoIP environment, the delivery of value added services is also endangered.

Although the markets in Europe show national particularities, certain conclusions can be drawn from the German market:

- The introduction of NGN should not endanger competition. The main task of society is to protect competition, which does not mean protecting competitors.
- The introduction of NGN has the potential to change the market.
- Technical (QoS, end-to-end connectivity, transport of billing information), legal (customer protection, data protection) and economic solutions (cost allocation, intercarrier prices, billing responsibility and information) are required to maintain the achievements that competition has brought about for value added services in a PSTN environment.

4.4 Impact of service convergence on markets

The European Commission has revised the recommendation on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation and significantly reduced the number of markets.⁵⁶ The only remaining retail market is access to the public telephone network at a fixed location. The list of markets on wholesale level reflects the technological evolution by defining both “bearer services” (wholesale physical network infrastructure access, wholesale broadband access and wholesale terminating segments of leased lines) and “teleservices” (call origination and termination on individual public telephone networks at a fixed location and voice call termination on individual mobile networks)⁵⁷.

Service convergence will lead to an increased significance of wholesale bearer services. These services still need to be shaped in order to become fit for the transparent conveyance

⁵⁶ European Commission (2007c)

⁵⁷ The terms “teleservices” and “bearer services” are used in the sense of chapter 2.1.

of different services. The progress of implementing such a service is differently far advanced in Europe. If this wholesale market provides a basis for competitive delivery of all electronic communications services, specific markets for services might become superfluous.

5. Will NGN lead to more competition?

NGN is the answer of the telecommunications industry to the challenges by Internet based business models. It presents opportunities to open up interfaces and modularize business models. NGN also brings the risk to enforce vertically integrated models and economies of scale.

We will answer the question in the header of chapter 5 this way: “NGN should lead to more competition”. This however will not happen without accompanying measures – of which some are of regulatory character demonstrating the continued need for regulation. These are discussed in this final chapter:

- Protect the competitive status achieved so far
- Observe network neutrality
- Promote the layered structure of the network by assessing the regulatory tool of separation especially with regard to appropriate incentives for investment in next generation access and core networks and services.

5.1 *Protect competitive status achieved*

The changes in technology as the source of providing services (section 2) and the business (section 4) also trickle down to the regulatory implications of the new technological environment (NGN). As has been demonstrated above, especially competition in services will change massively due to the fact that the structure in Next Generation Networks is completely different and consists of several layers. The simplicity of the current regulatory framework, which was developed in 2002 and transposed into national regulation in the member states in 2003, will undergo significant change driven by technical and economical evolution. It is difficult for those who currently work on this framework to assess how the best suited solution looks like. What should not be forgotten is that the competitive status achieved now

and steadily reported in the implementation reports of the European Commission should not be questioned but rather should be stabilized due to its positive effects for consumers. This means, that the benefits brought about by competition should not be endangered by new technological developments. This does not necessarily mean that specific business models or forms of competitive service provision shall be protected as they are but rather that competition as a principle shall remain as a goal as it benefits customers in the end. However, the technological and commercial initiatives demonstrated above seem to point in the direction which contains the certain risk of re-monopolisation. These examples also show that the introduction of competitive elements through regulation against the background of a certain technology is facing difficulties once technology undergoes massive changes and not only legacy elements of the old system are predicted to disappear but also achievements which so far have contributed to the success of a competitive market.

Even if service competition is achieved in such an environment, empirical evidence from a number of projects around the world show that it may be difficult to motivate the investment into the necessary basis networks. Such incentives to invest remain an additional important aspect to ensure the provision of services and to achieve service competition on a new technological basis.

5.2 Observe net neutrality

The EU Commission has provided new proposals regarding a review of the regulatory framework which shall be discussed between the commission and the European Parliament over the next 18 to 24 months and then enter into force. These contain some interesting aspects:

- First of all, the proposal for the revised universal service and data protection directive⁵⁸ contains in its article 20 (3b) the following provision:

“member states shall ensure that where contracts are concluded between users and undertakings providing electronic communications services and/or networks, subscrib-

⁵⁸ European Commission (2007b)

ers are clearly informed in advance over the conclusion of contract and regularly thereafter of any limitation imposed by the provider on their ability to access or distribute lawful content or run any lawful applications and services of their choice.”

- Also, article 20 (2) states that

“member states shall ensure that, where subscribing to services providing connection to the public communications network and/or publicly available telephone services, consumers have a right to contract with an undertaking or undertakings providing such services and/or connection”.

- Subsection 2 then goes on to identify the minimum content of such a contract. Furthermore, subsection 3 of article 20 states

“where contracts are concluded between consumers and electronic communication services providers other than those providing connection to public telecommunications network and/or publicly available telephone services, the information in paragraph 2 shall also be included in such contracts. Member states may extend this obligation to cover other end-users”.

These rules are obviously intended to enable customers to get free access to information in any form of combination of access providers and service providers. It presupposes a high degree of flexibility and a competitive environment. However, the technology today and the way networks will be built in the future contain separation of provision of services which can come from very many different providers (service providers, application providers, network providers etc.) and provision of access to the network. It will not always be clear to the end-user who provides the service and who is responsible for providing him with the respective information. Although the general rule as such sounds very good and pragmatic for consumers, it contains a high number of potential problems for the organization between the different providers of services respectively access. The freedom of choice given to the consumers may reach limitations when the various providers and undertakings/enterprises which can be involved in the provision of such a service are not able to reach an agreement on the issues described in the universal service directive and thus the lack of a functioning intercarrier relationship limits the customer’s rights to demand services as described above.

Therefore, the requirements that are put upon the coordination/cooperation of enterprises active in the provision of such services may constitute a hurdle to providing the customer with all the services he desires. This may for example be demonstrated when a customer

who has an access provider at his fixed location, which provides him also with specific services and applications, is using his e.g. laptop for mobile access in different places. The “access provider” (be it fixed or mobile) at this specific location may have other contracts, other partners and other services and application providers and this may constitute a problem in the provision of seamless services to the respective end-user. Therefore, the rule laid down in article 20 (2) and (3) seems to be potentially problematic for the future design of the regulatory framework.

5.3 Promote layered structure of the network

Another question that has to be addressed is the question of the separation between the different layers in Next Generation Networks in combination with the potential remedy of functional separation. Although the way functional separation – one of the most intensively debated proposals in the draft documents and obviously not even commonly agreed in the EU commission between different general directorates as being a tool that supports the achievement of certain goals by regulatory intervention – may be implemented as a remedy is not yet finally outlined and clear⁵⁹, one needs to consider as one of the main possibilities an approach where the network division and the services division are separated in order to create the best possible transparency also for the provision of wholesale and retail services⁶⁰. In previous times – some may remember that already before the introduction of competition in 1996/1997 some countries debated to split the incumbent, so that there would be one network for all independent service providers to use – it would have been easy to differentiate between networks and services, but this is not the case any longer. As the design of networks shows that there are still network elements, there are also service control layer and an application layer. The question therefore is who “rules” over these “network layers”? Shall this be allocated (in case of functional/structural separation) to the network company or to the service company? And if it is allocated to one of those two, what will be the economic effects for a seamless service position. This example also shows that the new technological and

⁵⁹ See ERG (2007)

⁶⁰ See Ruhle, Reichl (2008)

economical developments contain quite some hurdles with respect to dealing with a new environment in the regulatory framework in a consistent and useful way for market participants.

5.4 Conclusion

Regulators face the difficult task to follow the evolution of the market, which is driven by convergence of IT, telecommunications and media. The regulatory framework regarding services still distinguishes between regulatory regimes for electronic communications services, services for the information society and audio-visual services. Technological convergence will lead to a further convergence of the still different regulatory regimes. The way forward needs to balance this convergence against the need for regulatory certainty (which is a prerequisite for all stakeholders and especially those who intend to invest).

NGN should lead to more competition. This will not happen on its own. The measures discussed here are protecting the competition achieved, securing network neutrality and promoting the layered structure of the future network.

The policy framework from the authors' point of view needs to encompass all these elements and requires a careful assessment and impact analysis in order to determine the right way forward for shaping the optimal conditions for the market.

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