Fixed-Mobile Convergence

Regulatory Implications of the Convergence of Fixed and Mobile Telephony

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Preface

This report is the result of my Master Thesis Project, written as the conclusion to my study “Systems Engineering, Policy Analysis and Management” at Delft University of Technology. It investigates the regulatory implications of the convergence of the markets for fixed and mobile telephony. The theoretical part of the project has been to analyse whether the Structure-Conduct-Performance market paradigm and the Resource Based View of the firm theory are useful in finding and describing these regulatory implications.

My research was performed at OPTA - the national regulatory authority of the telecommunications industry of the Netherlands - supervised first by Daan Vrijmoet and later by Iris van der Hart. Daan has helped me to get an initial feeling for the subject and to formulate my research proposal. During the first phase he frequently helped me focus on my primary objectives. September 1st Daan decided that his task at OPTA had been fulfilled and that it was time to move on to the next challenge. Iris stepped forward and took over his role as supervisor of my project with relentless enthusiasm. She has been eager to read my findings and to discuss these with other OPTA specialists. As a result more OPTA specialists became involved in the project and the quality of my findings improved.

I am very grateful for the help of Daan and Iris and their effort in making this research worthwhile. Also, I am grateful to my supervisors at TU Delft; Rudi Westerveld, who helped me find an interesting subject and with the technical aspects of the research, and Andrew Barendse, without whom the academic value of this thesis would not have been as it eventually turned out. Furthermore, I would like to thank Professor Rene Wagenaar for monitoring the academic value of the project.

Many thanks to the representatives of market parties who granted me a moment of their time to interview them on the subject of Fixed-Mobile Convergence and their vision of the future of the telecommunications industry. These interviews were very helpful for the identification of potential regulatory issues that accompany the convergence of fixed and mobile telephony.

Thank you Jaco Appelman and Sandra van der Hulst, for facilitating and supporting the Group Decision Room session. I am also grateful for the enthusiasm of the participants of this session, among which were my TU Delft supervisors, OPTA employees and representatives from several market parties. Their input helped with generating solutions for the identified regulatory problems.

Herbert van Willenswaard and Jonas Rosenstok, thank you both for your patience and time spent on checking my grammar and monitoring the consistency within this thesis.

Finally, this report could not have been written without the help of the following OPTA specialists: Roderik Hylkema, Joos Francke, Frank van Berkel, Michiel Lugt, Robert Stil, Ester Ijskes, Herjan Barnard and Maarten Klijn.

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Executive summary

Integration of the mobile phone and fixed line infrastructure is called Fixed-Mobile Convergence (FMC). With the mobile and fixed networks integrated, telecommunications operators can provide services to the customer irrespective of access technology, location, and terminal. When outside the house, the consumer enjoys the benefits of mobility by means of GSM or UMTS. When inside, the same handset can be used to connect to the fixed network.

In the UK, British Telecom is currently running an FMC pilot in cooperation with Vodafone: project Fusion. With Fusion, the call handover process is not seamless; the customer will have to hang up and redial when switching networks. In the vision of FMC handover will be seamless. Without intervention of the user, the handset detects the availability of a fixed line, via a Bluetooth- or WiFi connection, and facilitates a transition from the mobile to the fixed network and vice versa.

The research questions of this thesis are:
1. **Within the new regulatory framework, how can markets be defined after the convergence of fixed and mobile telephony?**

2. **What regulatory challenges arise as a result of the changing market?**

The methods used in this research are a literature study, interviews with relevant market parties and a Group Decision Room session. The research was performed at the main office of OPTA, which made the knowledge of its employees easily accessible.

The theoretical framework of this thesis is based on two market paradigms: the Structure- Conduct-Performance (SCP) paradigm and the Resource Based View (RBV) paradigm. These theories provide a guideline for determining under what circumstances intervention by the regulator is desirable. SCP defines that it is the structure of a market that determines the conduct of the firms within that market and that this, in turn, determines market performance. RBV says that firms derive their competitive advantage from resources that are hard to replicate by their rivals.

The main tasks of OPTA can be subdivided into symmetrical regulation and asymmetrical regulation. Symmetrical regulation is applied to all providers of a public electronic communications service and consists of supervising compliance to the Telecommunications Act and European legislation. Asymmetric regulation is only applied to market parties with Significant Market Power. Significant Market Power is determined by first defining the relevant product market. On the relevant market, a party with Significant Market Power is determined based on the ability to behave independent of its rivals. Then, on the same relevant market, the necessity of intervention is determined after which remedies can be imposed.

Influences from both the SCP and the RBV paradigms can be recognised in OPTA’s regulation of the telecommunications industry. The emphasis on defining the market is clearly based on the assumption that market structure is an indication for market performance. The remedies that OPTA imposes often affect the availability of resources to the relevant market parties.
Fixed-mobile convergence is first and foremost a technological development that enables market parties to re-evaluate their strategies in acquiring a sustainable competitive advantage. In this thesis, we have formulated the definition of FMC as follows:

“Enabling the user to, while using any device, roam and handover seamlessly between a mobile and a fixed network, independent of the access technology that is being used. Handover to another network takes place based on costs, the need for bandwidth, the need for mobility and quality of service. The user can be reached at a single phone number.”

We recognise two phases of FMC, the situation as described above being the second one. The first step towards FMC is considered to be the bundling of fixed and mobile telephony.

One of the technological enablers of FMC is the rise of Voice over IP, which makes it possible to deliver voice services on other networks than the PSTN. Also the rise of wireless access technologies like WiFi and the introduction of UMTS make FMC possible. WiFi adds mobility to the previously fixed wire lines and UMTS enables mobile operators to offer services that require more bandwidth. Before UMTS, these services belonged solely to the domain of fixed operators. In addition to WiFi and UMTS a variety of technologies are being developed that enable network integration, UMA and IMS being the most widely adopted ones.

The customer has some clear benefits from FMC: using a single phone number, receiving one bill, reduced costs, using a single device independent of the network that it is connected to and the ease of one-stop-shopping. Fixed operators, including the incumbent, see FMC as an opportunity to attract more customers and increase the corresponding data traffic to their fixed line networks. With FMC, they try to counter Fixed-Mobile Substitution, which means that more and more customers choose to purchase a mobile subscription only.

The short term benefits of the mobile operators are low, because FMC means offering the customer a cheaper way of making a phone call when he is at home, obviously at the cost of the mobile operators’ revenues. In the long term however, FMC is an excellent means of product differentiation and gaining a competitive edge.

We expect the market parties, pursuing resources that give them a sustainable competitive advantage, to do so by acquisition of firms that have complementary resources. Considering FMC, a mobile network is a complementary resource for a fixed operator, and a fixed network is a complementary resource for a mobile operator. This means that in their pursuit of resources, firms change market structure towards a more horizontally orientated industry. This confirms that market conduct influences market structure and that causality within the Structure-Conduct-Performance paradigm does not run in one direction only.

The technological changes have their impact on the telecommunications industry. In the years to come, we expect the industry to be shaped more and more in a horizontal manner. This means that operators will arise that deliver voice services independent of the infrastructure used. These operators will primarily compete based on pricing strategies and product differentiation, thus improving market performance.

With the evolution from vertically integrated markets towards horizontally integrated markets, naturally also the product characteristics of voice services change. This has an impact on the relevant product markets defined by OPTA in order to determine SMP and impose remedies. Currently, OPTA has defined a market for mobile telephony and a market for fixed telephony. This distinction is based on functionality and price. Mobile telephony offers mobility: the
possibility of travelling large distances while maintaining a connection to the network. This mobility is not offered by fixed telephony. Also, mobile telephony is roughly twice as expensive as fixed telephony, when retail prices are considered.

Although technologies such as Bluetooth and WiFi offer a wireless extension of the fixed wire line networks, actual mobility is still not offered. There is also no indication that the difference in retail prices of fixed and mobile telephony will diminish in the years to come. Therefore we do not expect that the distinction between fixed and mobile telephony, based on functionality and prices, can be abandoned.

FMC raises the question whether an additional market could be defined for this service. We consider the two phases of FMC: first, a bundle of fixed and mobile telephony and second, FMC with network integration. The bundle of fixed and mobile telephony provides the consumer the benefits of one-stop-shopping, receiving a single bill, a possible discount and possibly flat rate or flat fee offers. FMC with network integration, in addition to the benefits of bundling, offers the benefit of always utilising the best available radio signal for that time and place, and additional functionality such as roaming between fixed and mobile networks, seamless handover and using one device with one address book and a single phone number.

Because of the prospective character of FMC, the SSNIP test can not be applied quantitatively. Therefore we use a qualitative approach to assess future market definitions. Based on this method, there is no reason to define a separate relevant product market for the bundle of fixed and mobile telephony. In case of FMC with network integration however, the extra functionality of the service distinguishes it with both fixed and mobile telephony. Based on our qualitative approach, a new product market for FMC could be defined separately from the product markets for fixed and mobile telephony.

The qualitative approach also provides an indication that an asymmetric market exists in case of FMC with network integration. This means that consumers are willing to switch from either fixed or mobile telephony to FMC based on functionality and price. However, they are not willing to switch back in case of an increase in price of FMC. This asymmetry is an indication that the markets for fixed and mobile telephony could diminish in time to the benefit of the market for FMC.

This development presents OPTA with a number of challenges. These challenges are generated with the help of interviews with market parties and a Group Decision Room Session. First, the necessity of enforcing access to FMC-specific network facilities of KPN must be assessed in phase two of FMC. Our vision is that a light regulatory approach without access regulation is appropriate. Market parties do not depend on KPN in order to obtain the resources necessary to offer FMC. Moreover, a light regulatory approach ensures that innovation is not hampered. However, would KPN become a market party with Significant Market Power on the retail market for FMC, an access obligation could become necessary to ensure optimal market performance.

Second, in the transition from phase one to phase two, it is important to remove possible entry barriers to the market of FMC. A crucial barrier today is the numbering plan, which does not allow the use of geographical fixed numbers or mobile numbers for FMC services. Another entry barrier, particularly for fixed operators, is the gap between fixed and mobile terminating tariffs and the fixed operators’ corresponding lack of capital necessary to enter the FMC market.
The third challenge for OPTA is to prevent anti-competitive behaviour by the incumbent. In its effort to leverage its market power onto the market for FMC, the incumbent could apply too low pricing or illegal bundling.

The fourth challenge for OPTA is to protect consumer interests in the transition from the current to the new market structure. Special areas that need attention are market transparency, life line services and quality of service.

Finally, OPTA should monitor industry structure developments and look for opportunities to withdraw regulation. The transition towards a horizontally orientated industry structure and the corresponding increased infrastructure independency of services, creates a level playing field in which more market parties are capable of competing with the incumbent. Following the reasoning of the Structure-Conduct-Performance paradigm, this decrease of concentration on the market results in increased market performance. Therefore the necessity of intervention by the regulator could decrease.

We recommend that FMC developments be monitored in order to frequently re-evaluate the product market definitions as currently used by OPTA. Furthermore, the opportunities presented by FMC to withdraw regulation should be further researched. Also, it is recommended that the implications of FMC are investigated in an international perspective. Network integration and subsequent changes in market structure are likely to have an impact on an international level. And finally, we conclude that this thesis presents a useful approach to investigate the implications of convergence in a broader sense. Both the theoretical framework and the methods used can be adopted to test the current regulatory framework on its ability to cope with convergence within the telecommunications industry.
# Table of contents

## Preface

## Executive summary

## 1 Introduction

1.1 Problem definition

1.2 Methods

1.3 Scope

1.4 Reading guide

## 2 Theoretical framework

2.1 The Structure-Conduct-Performance paradigm

2.2 The Resource Based View theory

## 3 Fixed-mobile convergence

3.1 What is fixed, what is mobile?

3.2 What is convergence?

3.3 Definition of Fixed-mobile convergence

3.4 Technological enablers of FMC

## 4 Current market structure

4.1 Structure of the market for fixed telephony

4.2 Structure of the market for mobile telephony

4.3 Who owns which resources?

4.4 The ability to acquire complementary resources for FMC
5 Changing market structure as a result of FMC

5.1 Customer demand as an incentive to acquire complementary resources for FMC

5.2 The market parties’ opportunities and threats of FMC

5.3 Market parties developing new strategies

5.4 Evolution towards a horizontal market structure

5.5 Product differentiation through innovative services

5.6 Changing market performance

6 The New Regulatory Framework

6.1 Symmetric regulation

6.2 Asymmetric regulation

7 Changing market definitions as a result of FMC

7.1 How an NRA defines markets: the SSNIP test

7.2 Current market definitions

7.3 Possibility of defining one product market for both fixed and mobile telephony

7.4 Introduction of a new market definition for FMC

7.5 Determining SMP on the market for FMC

7.6 Regulatory requirements for a new market for FMC

8 Challenges for OPTA

8.1 If necessary, enforce access to specific network facilities

8.2 Remove entry barriers

8.3 Prevent anti-competitive behaviour

8.4 Monitor consumer protection

8.5 If possible, apply regulatory withdrawal
# Table of contents

9  Conclusions ..................................................................................................................................93

10  Recommendations .....................................................................................................................97

Abbreviations .......................................................................................................................................99

Literature .............................................................................................................................................101

Figures and Tables.............................................................................................................................105

Appendix A: Markets defined by the European Commission .......................................................107

Appendix B: Choice of method.........................................................................................................111

Appendix C: Traditional network technologies ..............................................................................113

Appendix D: Dutch numbering plan for telephone and ISDN services ........................................115

Appendix E: Generic end-user obligations .....................................................................................117

Appendix F: The interviews with market parties ............................................................................119

Appendix G: Results Group Decision Room Session....................................................................121
1 Introduction

Summer 2005, British Telecom (BT) launched a revolutionary project named Fusion\textsuperscript{1}. BT’s Fusion offers a handset\textsuperscript{2} that is able to connect to the cellular network like an ordinary GSM, but when in range, it connects to BT’s broadband network using Bluetooth, thus cutting costs for the customer. BT is already working on the successor of Fusion, which will have WiFi instead of Bluetooth.

BT, having sold its mobile division O2, has teamed with Vodafone to provide the mobile network for Fusion. Vodafone is the second largest mobile phone operator in the Netherlands, so the announcement of BT and Vodafone to bring Fusion to the Netherlands did not come as a surprise. The largest mobile phone operator and fixed line incumbent on the Dutch market, KPN, has announced to respond to the plans of BT with their own new services and products, although the details of this response are not known yet.

Using a wireless device to connect to both the mobile network and the fixed line infrastructure is called Fixed-Mobile Convergence (FMC). With the mobile and fixed line networks integrated, telecommunications operators can provide services to the customer irrespective of access technology, location, and terminal. When outside the house, the consumer enjoys the benefits of mobility by means of GSM or UMTS. When inside, the same handset can be used to connect to the fixed line, providing the same services against lower costs and presumably with a higher quality of service. With Fusion, the call handover process is not seamless; the customer will have to hang up and redial. In the vision of FMC handover will be seamless. Without intervention of the user, the handset detects the availability of a fixed line, via a Bluetooth- or WiFi connection, and facilitates a transition from the mobile to the fixed network and vice versa.

In the Netherlands FMC is likely to be implemented considering the developments in the UK and the opportunities it provides for the market parties that are involved. The incumbent telecom operator KPN is dealing with traffic migration, which means that consumers’ usage of the fixed line diminishes, while mobile usage is growing. To stop this traffic migration, the incumbent is looking for ways to reclaim its market share. FMC is such a way.

Other market parties, such as cable companies and Internet Service Providers (ISP’s), are nowadays able to offer voice services using Voice over IP (VoIP). FMC enables them to offer the additional service of mobility to the consumer.

With FMC, mobile operators can create a bigger audience for the services they provide. Also, a competitive edge can be accomplished by offering the customer the possibility to switch between the fixed and mobile networks. Equipment vendors are already manufacturing handsets and network equipment that are suitable for FMC.

\textsuperscript{1} The initial name of this project was Bluephone.
\textsuperscript{2} The only available handset today is the Motorola V560.
1.1 Problem definition

Within the New Regulatory Framework (NRF), the National Regulatory Authority (NRA) OPTA has to perform market analyses on eighteen markets defined by the European Commission every three years. In these market analyses OPTA makes an assessment of the expected market developments in the three years to come and determines what remedies are needed in order to promote competition within the telecommunications industry. A period of three years was chosen as a compromise. A long period is desired because in the eyes of the telecommunications operators, there is the need for regulatory stability. This stability increases the companies' willingness to invest. Another argument for a long period is that the shorter the period, the more workload for both the regulator and companies to produce each market analysis. On the other hand a short period increases the ability of OPTA to respond to market dynamics.

Next to the tension described above, there is also a tension between the protection of end-users by imposing severe regulations, and allowing the market space to innovate by applying a light regulatory approach.

This thesis concentrates on the ability of OPTA to respond to technological change caused by the convergence of fixed and mobile telephony. This technological change presents the firms within the telecommunications industry with new opportunities and threats. Consequently, it can be expected that these firms will change their strategies. The firms try to acquire the resources necessary to optimally benefit from the new technological possibilities. As a result, market structure will change.

In this research, a theoretical framework is used that helps to explain the behaviour of market parties and the dynamics of the market as a result of this behaviour. The Resource Based View of the firm theory describes the conduct of firms trying to obtain resources that give them a competitive edge. The Structure-Conduct-Performance market paradigm is used to analyse the consequences of the changing market structure.

The regulatory framework of OPTA is to a large extent based on aspects from the Structure-Conduct-Performance paradigm. When analysing the market, OPTA defines a relevant product market based on the substitutability of products. Only on a relevant market where a market party with significant market power is active can OPTA impose remedies. FMC requires re-evaluation of current market definitions applied by OPTA. Also, a number of regulatory challenges arise as a result of the changing market. Therefore the research questions are:

1. Within the new regulatory framework, how can markets be defined after the convergence of fixed and mobile telephony?

2. What regulatory challenges arise as a result of the changing market?

Regulatory implications are expected because technically, FMC demands a high level of interconnection between the fixed and the mobile network. Also, cooperation between fixed and mobile operators can be expected, since there are significant benefits to bundling, such as cost benefits from integrated billing and marketing activities, and the possibility of offering lower

3 A list of these eighteen markets can be found in Appendix A.
tariffs. These technical and economic developments will certainly change the telecom landscape. Market parties will cooperate in new ways to interconnect their infrastructures and reduce costs. These implications are a legitimate reason to investigate whether regulatory challenges will arise and whether the regulator is capable of dealing with these issues within the current regulatory framework.

1.2 Methods
To answer the research questions the following methods were used. First, a literature analysis was performed to analyse both the technical and the economical context of FMC. Basic information about the way current telecom infrastructures function and the way they are interconnected was found in literature. More recent information about network evolution, technical innovations and market developments was found on the internet.

Second, experts from relevant Dutch market parties such as the incumbent, cable companies, mobile operators, and service providers have been interviewed. Equipment vendors who manufacture network components and handsets suitable for FMC were also approached. The goal of these interviews was not to acquire detailed technical information about the implementation of FMC, since the technology that can be used is very diverse and hardly fits into any discrete category. The purpose of the interviews was to ascertain the operators’ and vendors’ overall views on FMC: What is the definition of FMC? Is FMC likely to occur? What is your interest in FMC? Are you preparing for FMC? When can FMC be expected? What will be the impact on market development and competition?

To get a better understanding of developments in market structure and regulatory aspects the knowledge of OPTA employees was used, which was easily accessible since this thesis was written at OPTA’s main office.

Third, a Group Decision Room (GDR) session was held. In this session, a discussion was facilitated between the following people:
- Representatives from market parties;
- OPTA specialists on the subjects telephony, interconnection tariffs, and numbering;
- an ICT specialist from TU Delft;
- an economics specialist from TU Delft.

Goal of the discussion was to achieve consensus on the list of regulatory issues identified in the interviews. The issues were ranked on priority and solutions were generated.

1.3 Scope
This thesis will concentrate on voice services. The convergence of telephony and the internet will be treated as the environment in which fixed-mobile convergence takes place. Data services and television services are not part of the research. What will be considered is the possibility of offering voice services over data networks, since it can be argued that these services are substitutes for telephony over PSTN or GSM.

Several market parties were interviewed to gather information. However, the purpose of this thesis is not to identify the goals and course of actions of every single company that is involved. General statements can be made about for example the cable companies, using the information

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4 The reasons for using these methods can be found in Appendix B: Choice of method.
5 In Appendix F an overview of the questions asked in the interviews is given.
acquired from interviews and literature. This approach will be sufficient to identify potential regulatory issues.

The potential demand for converged fixed-mobile services could be estimated by performing surveys. However useful, this is not the purpose of this thesis. For this research, it is only important that market parties expect the customers to appreciate the services that come with FMC, and therefore choose to pursue an FMC strategy.

The scope of this research is limited to competition on a national level. Subjects like international roaming and competition on a European level are left aside. Also, the market definitions that are assessed in this thesis focus on the relevant product market. Possible implications of FMC on the geographical aspects of market definitions are left for further research.

1.4 Reading guide

First in Chapter 2 the theoretical framework of this thesis is presented. This chapter gives a literature review of the market paradigms used and the authors associated with these theories. Furthermore, the application of these paradigms in this thesis is explained.

Figure 1.1 gives an overview of the structure of the rest of this report.

Figure 1.1: Reading guide: the chapters of this thesis and their consistency

In Chapter 3 we explain the phenomenon of Fixed-mobile convergence and present a definition based on definitions used by prominent telecom organisations and the market parties that were interviewed. The technological innovations that drive FMC are also analysed in this chapter. Not only are these innovations expressed in the overall tendency of service convergence but in the rise of new access technologies and protocols as well.
Chapter 4 gives insight into the current structure of the fixed and mobile telephony markets. Additionally, the market parties’ access to resources relevant for FMC is analysed. Our analysis of the changes in market structure that can be expected as a result of market parties changing their strategies is then presented in Chapter 5. Also, a link is made to the changing market performance as a result of the changing market structure.

Chapter 6 gives an overview of the regulatory framework in which OPTA operates and the several tasks that accompany this framework. This chapter explains how OPTA performs market analyses in order to define relevant product markets, determines significant market power on these markets and, if necessary, imposes remedies for potential competition problems. We assess the impact of FMC on these product market definitions in Chapter 7.

In Chapter 8 we formulate a number of regulatory challenges that arise as a result of changing market definitions. These regulatory challenges are discussed and elaborated on. Finally, in Chapter 9 and 10 the conclusions and recommendations to OPTA are presented.
Fixed-mobile convergence, regulatory implications
2 Theoretical framework

This research addresses the following question: Within the new regulatory framework, how can markets be defined after the convergence of fixed and mobile telephony? Defining markets is an instrument that OPTA uses to impose remedies in order to achieve an optimal market performance. Two questions that immediately come to mind are: what market performance is considered to be optimal and how can this performance be achieved? To answer these questions a theoretical framework is used that describes which conditions determine the performance of the market and what intervention is necessary in order to establish this performance.

The theoretical framework consists of two market paradigms. As described by Kuhn (1962), a paradigm is “an accepted set of principles by which the world is viewed”. A market paradigm describes the causality within a market and thereby functions as a guideline for a regulator on how, when and where to intervene in a market and, most importantly, why. The market paradigms described in this chapter can be used to explain the market dynamics as a result of FMC. Second, they assist in deciding whether intervention in the telecommunications market is desirable after the convergence of fixed and mobile telephony.

At the end of this thesis a conclusion will be drawn about the applicability of these market paradigms in answering the main research questions of this research, and recommendations will be made for further analysis.

2.1 The Structure-Conduct-Performance paradigm

The Structure-Conduct-Performance (SCP) paradigm is a school of thought that was founded in the late 1940s and early 1950s (Mason 1939 and 1949, Bain 1956). SCP remained popular until the 1970s, when its importance declined once empirical research yielded only weak practical results and the market performance in an oligopoly market proved to be more difficult to forecast than the paradigm implies (Corley 1990).

As a result of fact that empirical studies failed to support the paradigm, there has been critique on SCP from several directions. The most important ones being Chicago Political Economy (Stigler 1957 and 1971, Demsetz 1967 and 1968, Brozen 1971, and Posner 1992), the Virginia School theory (Shughart and Tollison 1991) and the theory of Contestable Markets (Baumol et al. 1982).

In the late 1980s SCP re-emerged with the work of Perry and Porter (1985) and Farrell and Shapiro (1990), emphasising the importance of market share growth in case of a merger and the accompanying efficiency gains of the merged company in relation to market performance.

2.1.1 General properties

SCP defines that it is the structure of a market that determines the conduct of the firms within that market and that market conduct, in turn, determines market performance (Shepherd 1997). Figure 2.1 is a schematic representation. The criteria in Figure 2.1, by which structure, conduct and performance are measured, are examples.
The paradigm implies that a regulator, in order to influence market performance, first and foremost should try to change the structure of the market, that is, encouraging the market to move towards a less concentrated market (Shepherd 2000). Such a change of structure will change the way market parties behave. The change in behaviour will in turn cause the performance of the market to change. A way to decrease market concentration is removing entry barriers to a market, thus increasing the number of market parties (i.e. influencing market structure) (Bain 1956). According to the paradigm this will increase rivalry (market conduct) which in turn results in lower prices (market performance). It is also possible to regulate the market parties’ behaviour in order to influence market performance, for example by enforcing interconnection, or to regulate market performance directly, for example by imposing price caps (Yu 2004).

The SCP theory predicts that when the concentration of a market increases, market performance drops (Scherer and Ross 1990 and Tirole 1988). Increasing the market’s performance is the primary concern of the regulator. The SCP paradigm implies that the structure of the market is an important indicator for the performance of the market. For example, high prices (market performance) can be considered more probable in markets that are concentrated (market structure) than in markets that are less concentrated. Also, from a market party with a relatively low market share (market structure) the threat of anti-competitive behaviour (market conduct) is less expected than from a market party with a high market share (Shepherd 1970).

2.1.2 Literature review

Before the work of Edwin H. Chamberlin, economists mainly focused on the theory of pure competition, which assumes many sellers of homogeneous products, and pure monopolisation. In his dissertation “The theory of monopolistic competition” of 1933, Chamberlin focused more on markets that were not purely competitive. He recognised the behaviour of competitors to try to differentiate their products and their effort to emphasise the alleged superiority of their products over those of their rivals. Chamberlin combined competition and monopoly theories by formulating the results of a company differentiating its products. In doing so, the company faces a downward sloping demand curve, meaning that when it increases the price of its product, it will not lose all of its customers but the quantity sold will decrease. This situation is comparable to a monopoly. However, as more companies enter the market of the differentiated product, the demand curve tends to drop to an equilibrium where the company’s average total cost curve is met. In this case, monopoly profits disappear in the long run and the situation becomes comparable to pure competition.

The work of Chamberlin, combined with the analysis of Joan Robinson in “The economics of imperfect competition” of 1933, laid the foundation for the Structure- Conduct- Performance (SCP) market paradigm. What Chamberlin made clear is that market structure is not either

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6 As prescribed in the New Telecommunications Act.
monopoly or pure competition, but that in fact there is a continuum between these two extremes that can be described by the degree of concentration of the market. This continuum is represented in Figure 2.2.

<table>
<thead>
<tr>
<th>Pure monopoly</th>
<th>Oligopoly</th>
<th>Monopolistic competition</th>
<th>Pure competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One firm industry</td>
<td>1. Few Firms</td>
<td>1. Numerous potential buyers and sellers</td>
<td>1. Numerous potential buyers and sellers</td>
</tr>
<tr>
<td>2. No close substitutes for product</td>
<td>2. Decision making is mutually independent</td>
<td>2. Differentiated products</td>
<td>2. Homogeneous products</td>
</tr>
<tr>
<td>3. Substantial and effective barriers to entry</td>
<td>3. Major barriers to entry</td>
<td>3. No entry or exit barriers</td>
<td>3. No entry or exit barriers</td>
</tr>
</tbody>
</table>

Highly concentrated markets

Less concentrated markets

*Figure 2.2: Levels of concentration*

Based on this theory of market concentration, Mason (1939 and 1949) and Bain (1956) further developed the consequences of the level of concentration on market performance, as described in the SCP paradigm. Their analysis suggests that when industries are closer to pure monopoly, i.e. are more concentrated, they are more likely to exhibit high prices, low quantities and socially wasteful allocation of resources. In other words, they are inefficient. Industries that are closer to pure competition generally exhibit low prices, high quantities and produce the highest possible benefits to society. As Lopez (1999) concisely formulates: “In short, when the *structure* of an industry is defined (where on the continuum the market falls), the *conduct* of the firms will also be defined (price and quantity selections), and, as such, the *performance* of the industry can be determined (whether the market is good for society).”

Bain (1956) not only emphasises the importance of concentration considering market performance, but also the importance of barriers to entry. These barriers involve economies of scale, entry capital requirements, and product differentiation. The existence of entry barriers on a market enable the established firms to reap higher profits without being disciplined by potential entrants compared to a market with relatively lower entry costs.

Critical in the SCP paradigm is how to measure concentration. Bain (1956) uses an approach that has been dominant up to the 1980’s, the four-firm concentration ratio (CR4), in which the market shares of the four largest firms in the industry are added together. An obvious disadvantage of this approach is that all but the largest firms are ignored. A popular approach today is the Herfindahl-Hirschmann Index (HHI), in which the squared market shares of all firms in the market are added together. A HHI near to zero reflects pure competition (a large number of firms with infinitely small market shares). A HHI near to 10,000 indicates a pure monopoly (one firm with a market share of 100 percent) (Lopez 1999).

Before, OPTA based its determination of SMP primarily on market shares and used HHI to assess concentration. In the New Regulatory Framework however, OPTA does not use this quantitative approach in assessing the market for the presence of SMP. Instead, the NRA uses a more qualitative approach, based on the ability of a firm to behave independent of its rivals.

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7 According to Chamberlin (1933) and further developed by Mason (1939 and 1949), Bain (1956) and Shepherd (1970).
8 An example of product differentiation is advertising. An established firm having a strong brand and, consequently, a strong relationship with its customers, can keep potential rivals from entering the market. Entrants will have to make substantial costs to compensate with the advertising cost advantage of the incumbent firm (Comanor and Wilson, 1967).
Market conduct generally includes pricing behaviour, R&D, advertising, and product design. Market performance includes efficiency, product variety, innovation, and macro-economic stability (Scherer 1996 and Tirole 1988).

A fundamental problem with the SCP paradigm is that the theory implies that in an industry, causality runs from market structure, via market conduct, to market performance. This assumption denies the possibility that market parties can influence market structure. This influence means that causality also runs from market conduct to market structure (Ferguson 1988 and Wirth and Bloch 1995). The outcome of this thesis supports this theory of Ferguson, Wirth and Bloch. Moreover, our analysis is that the incentive to change market structure is driven by the behaviour of firms to try to gain resources, as described by the Resource Based View theory (section 2.2).

2.1.3 Application of the SCP paradigm in this thesis

The main subject of this thesis, FMC, is a development that takes place in the telecommunications industry. In short, this industry is characterised by network externalities, high sunk costs, economies of scale and scope and natural monopoly. These characteristics have their impact on the structure, conduct and performance of telecommunications markets. The structure of telecom is essentially oligopoly, conduct of firms is collusive (on prices and outputs) and the performance is low considering the high prices (above marginal costs) and the restricted output (below the efficient level).

When describing market structure we will apply the notion of concentration from Chamberlin, Mason, Bain and Shepherd. However, a quantitative approach such as the one used by Bain, CR4, and the one used after the 1980’s, HHI, will not be used. Instead, a more qualitative approach will be applied corresponding to the method used in the NRF. Based on the NRF, OPTA no longer determines the presence of SMP based on market shares, but on the ability of the firm to behave independently of its rivals. This approach will also be applied in this thesis. When describing market structure, we apply the following criteria identified by Chamberlin, Mason, Bain and Shepherd: the number of firms, the level of product differentiation and barriers to entry and exit.

We determine the market parties’ conduct by the behaviour of firms to differentiate their products in their effort to gain a competitive edge. Product differentiation can be achieved by either innovation or by acquisition of a resource that gives the firm a competitive edge. This behaviour can also be explained by the Resource Based View of the firm theory, which is described in the next section.

The performance of the market will be measured by prices (whether prices are fair considering the service delivered), product diversity, quality and innovation. The choice for these parameters is based on the main focus of OPTA, namely to promote competition in order to improve these four parameters. Whether prices are fair can be measured by comparing the price of the service to the costs made by the firm to deliver the service and whether the profit margin is excessive or not.
2.2 The Resource Based View theory

The Resource Based View (RBV) of the firm is a theory initiated by Wernerfelt (1984), Rumelt (1987) and Barney (1986). It has been well established in the strategy field for about 15 years and is still dominant today (Foss and Knudsen 2000).

2.2.1 General properties

The Resource Based View of the firm is a strategy theory that describes the behaviour of firms. The theory says that firms derive their competitive advantage from resources that are hard to replicate by their rivals (Selznick 1957, Andrews 1971 and Barney 1991).

From the RBV perspective, regulation should focus on non-replicable assets or resources. Non-replicable means that a potential competitor is not capable of reproducing an asset necessary to deliver a certain product or service. An example is the fixed copper wire lines owned by KPN. The costs of rolling out a similar network to the home of every Dutch inhabitant are extremely high, which makes duplication by a competitor impossible. Therefore, in order to promote competition, regulation forces the fixed line incumbent to provide access to its network, in order to enable competitors to enter the fixed telephony market.

2.2.2 Literature review

In RBV, the concept of resources is defined in a broader sense than in neoclassical economics, where physical and human capital were considered to be the primary resources. In the resource based view, also more intangible assets are included such as organisational capital, brand names, information, and intellectual property rights. By organisational capital the decision-making processes, coordinating systems, and established patterns of work are meant (Tomer 1987).

Barney (1991), one of the founding fathers of RBV, emphasised the necessity of the uniqueness of product market strategies in order to obtain a sustainable competitive advantage. This seems contrary to the RBV point of view, which claims that non-replicable resources are the source of competitive advantage. However, Barney points out that the uniqueness of market strategies is based on “a lower level of analysis, namely at the level of resources that a firm needs to access and control in order to implement its strategies” (Foss and Knudsen 2000). Barney describes that resources are “valuable when they help seizing an opportunity in the firm’s environment or when they help neutralising some threat in that environment” (Foss and Knudsen 2000).

RBV generally defines performance as the firm’s profitability. RBV writers often focus on the role of entry-barriers in accounting for performance differences among firms (e.g. Peteraf 1993). This point of view implies that the firm’s performance on the market is primarily the result of the firm’s own resources and industry barriers (the ability of rivals to replicate the resources). According to Peteraf, there are four cornerstones of competitive advantage: superior resources, forces that limit competition, imperfect resource mobility and \textit{ex ante} limits to competition. Superior resources are often the legacy of former public monopolies. Imperfect mobility means that the resource is relatively specific to the firm. \textit{Ex ante} limits to competition are trademark, copyright, patent, and intellectual property laws.

Critique on the RBV theory relevant for this research comes from Baumol \textit{et al} (1982). Their analysis shows that the assumption that performance is the result of the firm’s own characteristics, fails to take the form of competition in the industry into account. In other words, RBV does not take the influence of market structure on market performance into account. FMC
is expected to have an impact on market structure. In this research, we show that this change of market structure leads to a number of regulatory challenges that need attention in order to ensure optimal market performance. This conclusion supports the assessment of Baumol et al. that market structure has to be taken into account when determining market performance.

2.2.3 Application of the RBV theory in this thesis

The RBV theory explains the behaviour of firms when faced with opportunities or threats as a result of technological developments such as FMC. In this thesis we will use RBV to assess the strategies that market parties will develop in response to FMC and to predict the effects of these strategies on market structure.

The emphasis will be on technical resources relevant when a firm wants to offer FMC, namely having access to a fixed or a mobile network. Other tangible resources are only considered in relation to the previously mentioned resources, like physical capital necessary to gain access to a complementary network. When assessing dominance in the industry we will consider more intangible resources also, such as the incumbent’s brand and loyalty from its large customer base.
3 Fixed-mobile convergence

The goal of this chapter is to explain what FMC is. First we explain what exactly is meant by the terms fixed, mobile and convergence. Then we construct a definition of FMC with the help of definitions used in literature and interviews. FMC is first and foremost a technical phenomenon. Therefore when we have determined the definition of FMC, the technological enablers of FMC are described.

3.1 What is fixed, what is mobile?

Since wireless technologies like WiFi are present among the technologies that are involved, the difference between fixed and mobile networks could become unclear. To prevent this from happening an exact demarcation will be made of fixed and mobile networks in this section.

In this report, the mobile network is synonymous with the cellular network, also known as the Public Land Mobile Network (PLMN). So with the mobile network or mobile infrastructure, a cellular network or infrastructure like GSM or UMTS is meant. Also, mobile telephony means voice over a cellular network.

A fixed network is either the PSTN or a broadband IP network such as the internet, to which a connection can be made through copper wire, cable, ADSL or optic fiber. To connect to copper wire, cable, ADSL or optic fiber, wireless access technologies can be used (for example DECT, Bluetooth or WiFi). Although access to the network is wireless, this technology is still considered to be fixed, because of the characteristic that a fixed line has to be present and because the end-users’ ability of moving around freely while staying connected is limited. Therefore actual mobility is not offered.

Figure 3.1 explains the different terms that are used.

![Figure 3.1: Demarcation of fixed and mobile networks](image-url)
3.2 What is convergence?

In the previous section we have determined the difference between fixed and mobile. In order to completely comprehend the term Fixed-mobile convergence we will describe the term convergence in more detail in this section. Convergence literally means coming together in one single point. Hence Fixed-mobile convergence means fixed and mobile coming together. The distinction between fixed and mobile manifests itself not only in different networks, but also in the kind of services that can be delivered through these networks and the kind of organisations that deliver these services (Regtien 1998). Consequently, convergence can take place at each of the following three levels: technological convergence, market convergence and organisational convergence (Bauer 2001).

3.2.1 Technological convergence

Technological convergence refers to the physical integration of the fixed and mobile infrastructures. This integration is necessary to add particular functionalities to the network, such as seamless handover and roaming. Also, the ability to offer the same services on different networks requires a certain degree of technological convergence. In this thesis, technological convergence is also called network integration.

Telecom networks generally consist of three layers, each with its own function:

- **Application layer;**
  Consisting of application specific hard- and software.

- **Service enabling layer;**
  Providing the application layer with common information from the network, such as user identification, location information, etc.

- **Transport layer.**
  Here, the transport of data over the network takes place, including signalling, routing and discovery functions.

In traditional network architectures, each of these three layers is implemented specifically for each service. In other words, the networks are dedicated, optimised for delivering a single particular service. This means that for every service that is implemented in the network, not only an application layer has to be constructed, but also a service enabling layer and a transport layer. This property of traditional networks makes implementing a new service difficult and time consuming. Multiple implementations of service enabling functions mean increased costs and complexity. Also, it means that any particular service is designed especially for a specific infrastructure.
In next generation networks, technological convergence is implemented. This means that the network architecture will be designed in such a way that services will be independent of infrastructure. This can be accomplished by designing a service enabling layer and a transport layer that is suitable for any infrastructure and thus can be implemented horizontally. On top of these layers the different applications are situated. This way, only the application layer of a new service has to be designed, thus making the design of a new service easier and saving time and money.

Instead of a circuit-switched network topology, in next generation networks traffic is packet-switched using the Internet Protocol (IP). IP is applicable in both fixed and mobile infrastructures. Applying IP to both increases the potential interconnection and interoperability of these networks, thus making FMC possible. More about the transition to packet switched networks can be read in section 3.4.1.1.
3.2.2 Market convergence

According to Bauer (2001) “convergence often changes the product and spatial boundaries of existing markets or creates new ones”. This is called market convergence. There are two types of market convergence: convergence in substitutes and convergence in complements (Greenstein and Khanna 1997). Convergence in substitutes occurs when two products or services become increasingly interchangeable from a user perspective. Because with this type of convergence the choice options of users expands, convergence in substitutes tends to increase the effectiveness of competition (Bauer 2001).

Convergence in complements occurs when two (or more) products or services work better together than they used to (Greenstein and Khanna 1997). This can be the result of technological change altering the characteristics of the products or services making them more compatible with each other. Consequently, firms start offering the products or services as bundles that together form a product or service with additional value compared to the components being offered separately.

3.2.3 Organisational convergence

Organisational convergence can be defined as the integration of formerly separate functions into one enterprise (Bauer 2001). This type of convergence takes place when various divisions within a company merge. Divisions that are suitable for mergers of this kind are marketing, customer care and distribution. These mergers within a company are pursued because they increase efficiency and reduce overhead costs.

Mergers and acquisitions are also examples of organisational convergence. The choice of a firm to expand by merger or acquisition is strongly influenced by the cost of conducting transactions via a market as opposed to internalising an activity within the firm (Coase 1937 and Williamson 1975, as quoted by Bauer 2001). Hence the choice to integrate an activity into the firm is likely to be made when there is the expectation of economies of scale and scope.

Mergers and acquisitions by nature increase market concentration. Conduct by market parties seeking resources to increase their competitive advantage, apply strategies such as price differentiation and bundling of services. These strategies may have a negative effect on market performance if the market becomes too highly concentrated, if bottleneck problems arise, or if consumers face switching costs (Shepherd 1997). The presence of such structural characteristics may give suppliers an intolerable amount of market power. Therefore such increases in market concentration are carefully monitored by the regulator.

3.2.4 FMC and the levels of convergence

FMC is first and foremost a technological development. Technological enablers, described in section 3.4, instigate technological convergence between fixed and mobile networks. This technological convergence offers the opportunity to offer new products and services with increased functionality and thereby added value. This increases the potential benefits from organisational convergence to relevant market parties. Firms developing new strategies results in either convergence in substitutes or convergence in complements on the market level.

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9 Note that offering the firm for takeover is also a means of seeking organisational convergence, next to the more proactive alternatives of merger and acquisition.
3.3 Definition of Fixed-mobile convergence

In telecommunications literature and in publications, there seems to be little consensus about the definition of FMC. Still, several commonalities between the definitions can be found.

In Table 3.1 a list of different definitions from several sources is presented.

<table>
<thead>
<tr>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETSI Ad Hoc Group on Fixed/Mobile Convergence</td>
<td>“Fixed Mobile Convergence (FMC) is concerned with the provision of network capabilities which are independent of the access technique. This does not imply the physical convergence of networks. It is concerned with the development of a converged network architecture and supporting standards. This set of standards may be used to offer fixed, mobile or hybrid services. An important feature of Fixed-mobile convergence is the separation of the subscriptions and services from individual access points and terminals and to allow users to access a consistent set of services from any fixed or mobile terminal via any compatible access point. An important extension of this principle is related to inter-network roaming, users should be able to roam between different networks and to be able to use the same consistent set of services through those visited networks.”</td>
</tr>
<tr>
<td>Ofcom</td>
<td>“Fixed mobile integration is the designing of telecommunications services using both fixed and mobile technologies to maximise the controlled availability to consumers of telecommunications services, both outgoing and incoming, independently of the technologies that underlie the delivery of the services. It can be summed up in layman’s terms as the delivery of &quot;seamless&quot; services to customers without their or their callers needing to choose the technology that provides the service.”</td>
</tr>
<tr>
<td>Motorola</td>
<td>“Seamless Mobility is a vision for converged wireless telecommunications services that places the user at the centre of the network. The user will have a common experience whether they are at home, in their car, on the move or at work. As users move from one environment to another, they will receive continuity of experience seamlessly. The user will be presented with information and services relevant to their current time, location and access device. The services will be delivered using the most appropriate access network. There will be seamless handover between networks as the user moves from one environment to another.”</td>
</tr>
<tr>
<td>Asia Pacific Telecommunity</td>
<td>“Fixed and Mobile Convergence (FMC) is the ability of the customer to obtain both fixed and mobile services from one service provider. From a service provider perspective, it is the ability to deliver services from an integrated network. Fixed-mobile convergence inherently results in greater flexibility, more freedom, lower costs and simplified communications.” “For the consumer, it would mean the merging of fixed and mobile communications services into an integrated service package, whereby the consumer is offered both fixed and mobile services, using one terminal and possibly one number, and one bill.” (Singh 2002)</td>
</tr>
</tbody>
</table>

Table 3.1: Definitions of FMC, obtained from literature

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11 www.ofcom.org.uk.
Also a list of definitions\textsuperscript{13} is constructed by means of interviews with a number of Dutch companies. This list is presented in Table 3.2. Because of the risk of exposing possible strategies to competitors, an agreement has been made with the market parties to use aliases instead of the real company names.

| Fixed network owner | “Fixed-mobile substitution, fixed-mobile integration and triple play are all phenomena that are conceived to be part of FMC. Convergence at its ultimate form can be seen in the integration on the service level, as is the case in the Fusion project of BT in the UK. But also bundling fixed and mobile telephony, in which the services actually remain separated, is generally seen as a form of FMC.” |
| Equipment vendor | “(company name) sees FMC as offering the customer the possibility of using a certain communications service independent of his device and independent of his location.” “The user will carry a wireless device, but whether that device is connected via WiFi, GSM or any other access technology is of no concern to the end-user. His only concern is that all services are accessible.” |
| Fixed network owner | “Accessibility with a single phone number or another means of identification, supporting different forms of communication independent of the user’s location and independent of the network that is used.” |
| Mobile network owner | “There is a distinction between mobile access networks and fixed access networks. FMC means to offer telecommunications services on both networks, with the ability of seamless handover from one network to the other.” |
| Service provider | “With the convergence of fixed and mobile the service that the customer has access to is becoming less dependent on the access technology that the customer uses.” “FMC in a more advanced phase offers roaming between a WiFi operator and a mobile operator. The user will then be able to continue its conversation while moving from one network to the other.” |
| Service provider | “Telephony will evolve towards personal numbering. This means that we will no longer call a family or a device on a specific location, but instead we will call the person that we are looking for directly. An important aspect is that the customer should not be bothered with the technology that makes this all possible.” |
| Mobile network owner | “Offering services, independent of the infrastructure that is used. It doesn’t matter to the customer whether he is being served through cable, xDSL, satellite, GPRS or UMTS.” |
| Service provider | “We consider FMC to be a situation where the end-user uses one device that is accessible with one phone number. Technically speaking the networks remain physically separated, each with its own routing and signaling. In FMC we add a so-called “black box”, where all traffic comes in whether it is originated in a fixed or a mobile network. In the black box the location of the receiving party is determined and a choice is being made for further routing. The technical adaptations are mainly in signaling and routing.” |
| Fixed network owner | “From the customers point of view FMC means being reachable at the same device and at the same number on both the in-house fixed wire line and the GSM network outside the house.” |
| Mobile network owner | “FMC means using one phone with one number from which a call is processed via a fixed line in a fixed environment and via a mobile network in a mobile environment.” |

\textit{Table 3.2: Definitions of FMC, obtained from interviews}

\textsuperscript{13} The interviews were held in Dutch. The definitions in this table are freely translated into English by the author of this thesis.
The definitions that are listed in Table 3.1 and Table 3.2 have a number of characteristics in common:

- **Personal numbering (PN);**
  The user can be reached by a single phone number.

- **Devices are independent of access technology;**
  The user does not have to switch devices when he wants to switch service or infrastructure.

- **Services are independent of access technology;**
  The user can use the same services through any infrastructure that is available (and, in accordance with the previous characteristic, any device can be used for any service).

- **Seamless handover and roaming on different networks.**
  When moving from one infrastructure to another, the same service can be used without having to disconnect and reconnect. The user is not aware of the technology that enables him to be independent of access technology and to experience seamless handover and roaming on different networks.

Using these common perspectives on FMC, we can construct the following definition:

**Definition of Fixed-mobile convergence:**

"Enabling the user to, while using any device, roam and handover seamlessly between a mobile and a fixed network, independent of the access technology that is being used. Handover to another network takes place based on costs, the need for bandwidth, the need for mobility and quality of service. The user can be reached at a single phone number."

Note that the terms fixed and mobile correspond to the terms as explained in section 3.1. Note also that, due to the technical approach of this research, the definition primarily covers technological convergence, as discussed in section 3.2. However, combining FMC with convergence at the organisational and/or market level potentially offers great opportunities for both the operator and the consumer.

Both in literature and by market parties different phases of FMC are recognised. The definition above is considered to be the ultimate form of FMC. FMC at a less advanced phase is bundling fixed and mobile telephony. These different phases are shown in Figure 3.4.
In this report we define the two phases of FMC as follows:

- **Phase 1: Bundling fixed and mobile telephony;**
  In this phase convergence primarily takes place at the organisational level. Fixed operators will enter the mobile telephony market and mobile operators will enter the fixed telephony market. Companies offer a bundle of fixed and mobile telephony or integrate mobile telephony in their multiple play strategy. The customer enjoys one-stop-shopping, receives a single bill and possibly receives a discount compared to purchasing fixed and mobile telephony separately.

- **Phase 2: FMC with network integration.**
  In phase 2 of FMC a high level of network integration is achieved. In addition to the benefits of phase one, the customer has the benefit of always utilising the best available radio signal for that time and place. Intelligent Networking (IN) makes roaming and seamless handover between fixed and mobile networks possible. The situation as described in the definition of FMC has been reached.
3.4 Technological enablers of FMC

FMC is not new. Years ago among others Sagem and Siemens have experimented with telephones that could use both GSM and DECT. Although these phones were launched on the market, this experiment never really took off. The phones were too big and ordinary mobile phones offered services that were not available on the GSM/DECT phones. Also, it was not possible to handover seamlessly between the networks.

![Diagram of GSM/DECT solution of the late 90's](image)

*Figure 3.5: The GSM/DECT solution of the late 90's*

Before, DECT was the only short-range wireless technology that lent itself for FMC. Today, Bluetooth and WiFi are alternatives that offer a higher bandwidth and can be implemented in smaller devices. These characteristics, along with an increase of mobile services and customer demand for both bandwidth and mobility, renew the opportunities and thereby the enthusiasm for FMC.

Not only the availability of Bluetooth and WiFi, but also the possibility of making phone calls over IP networks is a push towards FMC. This possibility, combined with the availability of Bluetooth and WiFi, results in the FMC solution as represented in Figure 3.6.

We discuss the technical innovations that will eventually lead to FMC. The major trend in telecommunications that can be seen today is that of service convergence. Service convergence means that the strict relation between a service and the infrastructure that it was traditionally delivered on, is departed from. Additionally to service convergence there are several Next Generation Network (NGN) access technologies that will enable the industry to take the next step towards FMC.
3.4.1 Technological convergence in the telecommunications industry

To get a clearer vision of the place of FMC in relationship to other developments like VoIP and Triple Play, a summary is given of the evolution of network architecture that currently takes place in telecommunication. Traditionally, services were offered on single service networks, also known as "stovepipes". This means that each service was offered to the customer through a specific infrastructure. Fixed voice calls were made over the Public Switched Telephone Network (PSTN), mobile phone calls were made using GSM/TDMA, television broadcasting was offered via cable (CATV\textsuperscript{14}) and the internet was offered on data networks using IP. Figure 3.7 is a schematic representation of the traditional network architecture.

\textsuperscript{14} The acronym CATV originally stood for Community Antenna Television, but now that the use of cable is more common than the use of an antenna, CATV is synonymous with Cable Television.
Telecom operators are moving towards a network architecture where services can be offered independent of the infrastructure that is used. The aim is offering "any services, any time, any where, any device". An architecture that is shaped in that ideal way is called a telecommunication ecosystem. Figure 3.8 is a schematic representation.

The first steps toward the next generation network can already be seen. Fixed voice services are no longer provided only over the PSTN, but are also available via cable and xDSL, using VoIP. Another example is Triple Play, which is offered by KPN, Carrier Pre Select (CPS) operators and several cable companies. Using a single infrastructure (i.e. xDSL or cable) internet, television and telephone services are offered.

In the mobile market there are also examples of service convergence. Cellular operators are moving into the area of data services and the internet, once the sole domain of the fixed-line operator. Of course data services have been available for quite some time now, namely through GPRS, but UMTS and HSDPA offer greater opportunities due to a higher bandwidth. Mobile communication is increasingly becoming a multimedia environment that will no longer be limited to two-way voice and low-spectrum rate data services (Huber and Huber 2002).

The next step is the integration of the fixed and mobile infrastructures, making the same services available on both. This is where fixed-mobile convergence takes place.

3.4.1.1 From Circuit Switched networks to Packet Switched networks

There are roughly two ways to send data over a network: either by circuit switching or by packet switching (Walrand 1998). Traditionally, the telephone network uses circuit switching and the internet uses packet switching. In circuit switched networks, when two persons want to talk to

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15 Note that the terminals that are displayed here are traditional terminals. In reality, new terminals like PDAs and others we probably can not even imagine will gradually replace currently known devices.
each other, a connection is set up between these persons for the duration of the phone call. In order to establish this connection, the network reserves capacity on the links between the users and connects the links together. The capacity is allocated to these two persons for the duration of the conversation, whether it is used or not.

In packet switched networks, data is packaged into groups of bits in advance of the actual transmission. In each package additional information is included in a so-called header. This includes information about the source and destination of the package, priority, the way the datagrams should be reassembled, error control and what higher level protocol is contained in the data packet itself. The packets are sent on the network one at a time. In the network, based on the additional information in the header, each router is capable of making a decision where best to send the package next in order to eventually reach its destination.

Each of these methods has its advantages and disadvantages. In circuit switching, the downside is that an amount of capacity is reserved for the entire conversation, while practice shows that in a conversation there are many moments that no one is talking. Also consider the fact that generally in a conversation only one of the persons is talking so capacity is only necessary in one direction. Another disadvantage is that circuit switched networks require considerably more bookkeeping and maintenance than a packet switched network to supervise the connections, making circuit switching more expensive.

A disadvantage of packet switching is the extra amount of data that has to be sent along with each packet, thereby increasing the need for bandwidth. Also, the quality of service of a circuit switched network is considerably higher than that of a packet switched network, since the connection between the source and the destination is set up and guaranteed.

Table 3.3 gives an overview of the most important pros and cons of circuit switched and circuit switched networks.

<table>
<thead>
<tr>
<th></th>
<th>Circuit switched networks</th>
<th>Packet switched networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>High quality of service</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Low bandwidth required</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>High efficiency</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Low costs</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 3.3: Pros (+) and cons (-) of circuit switched and packet switched networks

In telecommunication networks, a shift can be seen from a circuit switched architecture towards a packet switched architecture. Where in the past the circuit switched PSTN was the only publicly available infrastructure for voice and data transmission, today data is mainly transmitted by packet switched networks. With the introduction of Voice over IP also voice can be sent by packet switching, thus reducing costs and increasing the efficiency of the networks. These are the main reasons that a transition to IP is expected in the years to come. Already in the backbone of the PSTN itself IP is used for trunk transmission of both voice and data. Figure 3.9 is a schematic representation of this development.
The protocol that is generally accepted to be leading in future networks is the Internet Protocol (IP). IP is applicable in both fixed and mobile infrastructures. Applying IP to both increases the potential interconnection and interoperability of these networks, making the transition to IP an enabler for FMC.

A major benefit of IP is increased efficiency. Traditionally, in circuit-switched networks, one channel was dedicated for the connection between terminals for as long as the communication took place. This meant that when during the session no data was exchanged, the channel was not available for other terminals. In a packet-switched environment, channels can be used for more connections at the same time, thus reducing the need for network capacity and lowering the corresponding costs.

Maintaining a network that is based on IP is also a lot cheaper than maintaining a circuit switched network.

3.4.1.2 Voice over IP

Part of the service convergence as explained in section 3.4.1 is the convergence of voice and data. Before, fixed voice services could only be delivered by a specific infrastructure: the PSTN. Today, voice can be delivered through any infrastructure that supports the internet protocol. Delivering voice in such a way is known as Voice over IP (VoIP).

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16 (Ibe 2002).
Five categories of VoIP can be identified:

1. **IP on internal carriers;**
   On the backbone of telecom operators, today both voice and data are often transported using IP.

2. **VoIP in company networks;**
   Companies can use VoIP to make phone calls between their offices. This network is often connected to the PSTN by a gateway.

3. **Peer to peer internet telephony;**
   Using specific software, voice calls can be set up on the internet. Calls can only be set up between clients that use the same software and there is usually no connection to the PSTN. Voice calls are free of charge. There is no quality of service management but the connection is "best effort".

4. **IP telephony;**
   Voice calls are made over a broadband internet connection. An IP telephone can be used or a POTS telephone with an additional piece of equipment (a router). The user can be reached at a specific phone number wherever he or she connects to the internet. There is a connection to the PSTN available. The customer is charged per minute and calling to other customers of the same operator is often free of charge.

5. **Voice over Broadband (VoB).**
   Additional to an xDSL connection a voice service is offered, usually Voice over DSL. In contrast to IP telephony this service uses the transport protocol layer. As a result, the nomadic feature is not available. Hence the phone number is related to a geographical area, i.e. a fixed wire line. This type of VoIP is the most comparable to a traditional phone service over PSTN.

These categories are represented in a schematic drawing in Figure 3.10.

VoIP is an enabler for service convergence since it makes voice services that were traditionally offered only on the PSTN and on mobile networks increasingly independent of infrastructure. Now the owners of data networks can also provide telephony.

The cost of making a voice call through VoIP is either zero or very low compared to traditional PSTN. This feature enables companies to enter the fixed voice market more easily, thus making FMC attractive for more market parties.

### 3.4.1.3 Mobile multimedia services

Mobile communication is increasingly becoming a multimedia environment that will no longer be limited to two-way voice and low-spectrum rate data services (Huber and Huber 2002). The technologies UMTS and HSDPA increase the amount of bandwidth available for the mobile user, making more and more bandwidth-consuming services like teleconferencing, video on demand and television possible. This means that these services, that were traditionally offered only on fixed networks, are now becoming increasingly infrastructure independent.

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17 OPTA, Beleidsregels nummers voor VoIP diensten, April 2005.
Fixed-mobile convergence

Figure 3.10: Five categories of packet switched voice services

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Plain Old Telephone System</td>
</tr>
<tr>
<td>1</td>
<td>IP on internal carriers</td>
</tr>
<tr>
<td>2</td>
<td>VoIP in company networks</td>
</tr>
<tr>
<td>3</td>
<td>Peer to peer internet telephony</td>
</tr>
<tr>
<td>4</td>
<td>IP telephony</td>
</tr>
<tr>
<td>5</td>
<td>Voice over Broadband (VoB)</td>
</tr>
</tbody>
</table>

---

3.4.2 The rise of wireless access technologies

In the previous sections we have shown that technological convergence is picking up at a rapid pace. In this section we discuss the technologies in NGNs that will provide access to the different services. In Table 3.4 we present a list of relevant technical characteristics per wireless access technology.

<table>
<thead>
<tr>
<th></th>
<th>Theoretical Data Rate</th>
<th>Experienced Data Rate</th>
<th>Typical Range</th>
<th>Mobility support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetooth</td>
<td>1 Mbps</td>
<td>1 Mbps</td>
<td>10 m</td>
<td>Technology by itself does not support handover</td>
</tr>
<tr>
<td>UWB</td>
<td>110 Mbps (at 10 m)</td>
<td>110 Mbps (at 10 m)</td>
<td>10-15 m</td>
<td>Technology by itself does not support handover</td>
</tr>
<tr>
<td>WiFi 802.11b</td>
<td>11 Mbps</td>
<td>5.5, 2 or 1 Mbps, depending on distance and interference</td>
<td>50 m at 11 Mbps 80 m at 2 Mbps</td>
<td>Movement within a cell is possible. Technology by itself does not support handover</td>
</tr>
<tr>
<td>WiFi 802.11g</td>
<td>54 Mbps</td>
<td>25 Mbps¹⁹</td>
<td>50 m at 11 Mbps 80 m at 2 Mbps</td>
<td>Movement within a cell is possible. Technology by itself does not support handover</td>
</tr>
<tr>
<td>WiMAX 802.16e</td>
<td>75 Mbps</td>
<td>Not available yet</td>
<td>30 km with LoS²⁰ 4 km without LoS</td>
<td>Without LoS handover between adjacent cells is possible at walking speeds</td>
</tr>
<tr>
<td>GPRS</td>
<td>171 kbps</td>
<td>30 kbps</td>
<td>1-5 km in urban areas</td>
<td>Handover is possible at high speeds</td>
</tr>
<tr>
<td>EDGE</td>
<td>472 kbps</td>
<td>128 kbps</td>
<td>1-3 km in urban areas</td>
<td>Handover is possible at high speeds</td>
</tr>
<tr>
<td>UMTS</td>
<td>2 Mbps</td>
<td>384 kbps</td>
<td>1-3 km in urban areas</td>
<td>Handover is possible at high speeds</td>
</tr>
<tr>
<td>HSDPA</td>
<td>14 Mbps</td>
<td>1.5 Mbps</td>
<td>1-3 km in urban areas</td>
<td>Handover is possible at high speeds</td>
</tr>
</tbody>
</table>

Table 3.4: Technical characteristics per wireless access technology²¹

The technologies in Table 3.4 can be subdivided into four categories. In the following sections, the most important features of Wireless PAN, Wireless LAN, Wireless WAN and Wireless MAN are elaborated on and compared to each other.

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²⁰ LoS is an abbreviation for Line of Sight.
²¹ Derived from Baken (2004).
3.4.2.1 Wireless PAN technologies

Wireless Personal Area Network (PAN) technologies are technologies that operate at close distances only. This makes them applicable for establishing connections between devices that are typically close to each other, like PC’s and printers or GSP devices and PDAs. They are also suitable for ad-hoc networks.

**Bluetooth**

Bluetooth is a short range radio access technology that is capable of sending data at a maximum bit rate of 1 Mbps with a maximum range of about 10 metres. The costs of a Bluetooth chip have declined considerably in the past years, making integration in mobile handsets increasingly interesting. As a result, a wide range of handsets today supports Bluetooth. Among popular applications that use Bluetooth are wireless headsets for mobile phones and GPS devices combined with PDA’s.

As described in the introduction of this thesis, BT uses Bluetooth in its Fusion project to connect the mobile phone to the fixed wire line. The reason that BT uses Bluetooth in its Fusion project is the low power usage of this technology. WiFi uses a lot more power, which is still a barrier to overcome. Nevertheless, we expect that WiFi will play a leading role in future FMC propositions, because Bluetooth has a limited range and offers low bandwidth. Therefore Bluetooth is not considered to be applied in future FMC propositions at all. However, since the emphasis of this research is on voice, Bluetooth is considered, because it is perfectly capable of transmitting voice. Additionally, Bluetooth has the advantage of being widely adopted in mobile handsets, and therefore is a potential technology for FMC on the short run.

**UWB**

Ultra Wideband (UWB) is a short range technology that uses a wide range of radio frequencies and a sophisticated multiplexing technology. This enables it to deliver high speeds of data with Quality of Service, making it suitable for the same applications as Bluetooth but additionally for multimedia applications like transmission of DVD files. The limited range makes that UWB is not preferable for FMC propositions. Because of its limitations UWB is not part of the rest of this thesis.

3.4.2.2 Wireless LAN technologies

Wireless Local Area Network (LAN) technologies are radio technologies that have a maximum range that enables the end-user to cover for example an entire house or a campus.

**WiFi (802.11b/g)**

WiFi uses the unlicensed band for transmission. As the term indicates, for the use of this band no license is necessary. However, this does not mean that there are no regulations involved. There is a restriction for the power used to transmit in the unlicensed band. The reason for this is that when transmission power increases, also does the chance of interference. The maximum transmission power allowed in the unlicensed band is 100 mWatt. Consequently, there is a maximum transmission range for Bluetooth (which also operates in this frequency band) and WiFi as a result of the power restriction.

At the moment of writing this thesis the first wireless handsets equipped with WiFi become available for the consumer. There are indications that there are still some issues with power usage to be solved, but the prospects are promising.
Being capable of transmitting at high bit rates over relatively large distances makes WiFi the most promising technology for usage in FMC.

3.4.2.3 Wireless WAN technologies

A wireless Wide Area Network (WAN) technology is capable of covering an area of several kilometres in diameter.

**GSM and GPRS**

The introduction of GPRS in GSM networks created the possibility of sending data to and from a mobile phone. This meant that services that before could only be delivered by fixed networks now also became available on mobile networks. Therefore GPRS has been the first step of infrastructure independency among fixed and mobile networks.

Because of its limited bandwidth however, GPRS is not expected to be used in an FMC proposition. For voice services only GSM itself is suitable and in fact BT uses GMS in its project Fusion.

*Figure 3.11: GSM architecture including GPRS*

The representation of GPRS implemented in GSM in Figure 3.11 is useful for understanding UMTS, because a lot of basic principles from GPRS are implemented in UMTS.
UMTS and HSDPA

Figure 3.12 shows the network architecture of UMTS.

Figure 3.12: UMTS architecture

Figure 3.12 shows that the UMTS network has adopted many of the GPRS features. As is the case in GPRS, speech and data are handled separately in the network in UMTS.

High Speed Downlink Packet Access (HSDPA) is a software upgrade in UMTS that allows the bandwidth to increase to up to 1.5 Mbps. If the UMTS network is in place, installing HSDPA is relatively easy and can be done at relatively low costs.

Vodafone has already rolled out UMTS and has about 60 percent coverage. The company offers video-calling and television via UMTS. It is the intention of Vodafone to roll out HSDPA in 2006. KPN also offers UMTS and has plans to introduce HSDPA in 2006. Telfort has focused its strategy mainly on EDGE. Its UMTS network is not yet in place but will be suitable for HSDPA when rolled out. T-Mobile has chosen to wait with offering UMTS until its network is completely suitable for HSDPA. The company expects to achieve this in 2006. Orange is also busy rolling out its UMTS network. Its strategy on HSDPA is not known.

Being a Wireless WAN technology which means high coverage and mobility and because of its relatively high bandwidth, UMTS is an outstanding technology suitable for an FMC proposition.

3.4.2.4 Wireless MAN technologies

The term Wireless MAN is mainly used for technologies that use a single transceiver to cover an entire city. Theoretically, WiMAX is a technology that is capable of such coverage.

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22 The strategy of Telfort since it was bought by KPN is not known.
WiMAX (802.16)

WiMAX is a Metropolitan Area Network (MAN) that, contrary to WiFi, operates in licensed band frequencies. The goal of IEEE is to obtain licenses for WiMAX on a global scale. Realising that this is unlikely to succeed worldwide in the same frequency band, WiMAX is designed to be able to operate at different frequencies, making it compatible with the different frequency plans of different countries (Smith and Meyer 2005). For the same reason, WiMAX supports both Time Division Duplexing and Frequency Division Duplexing.\(^\text{23}\)

WiMAX can be used for a wide range of purposes. The main reason that it is part of this thesis is its capability to extend the fixed wire line. This is the same purpose of WiFi, but WiMAX can do it on a metropolitan scale. It is a Wireless Local Loop (WLL) technology, and thereby an alternative for the incumbents copper wires in the local loop.

Considering its range, WiMAX is also a potential substitute of cellular technologies (GSM and UMTS) (Singh 2002). This characteristic offers the opportunity to fixed operators to offer mobile services, which is a potential threat to current mobile operators.

There are some limitations. The first limitation is transmission power. Transmitting data over large distances demands a relatively high level of power. With WiFi there already is the problem of batteries quickly running empty. With WiMAX this problem will be even bigger. This limits the possibility of using small handsets with small batteries.

A second limitation is public health. WiFi is limited to 100 mWatt (section 0), primarily to avoid interference, but according to some also to ensure that public safety is not harmed by excessive radiation. This issue is a subject of debate.

A third limitation is the frequencies that are used by WiMAX. The high frequencies will not necessarily be able to penetrate buildings. Users inside a building will use an external antenna. WiFi has the same problem, but the difference is that a WiFi hotspot can be installed inside the house, whereas the purpose of WiMAX is to cover areas as big as an entire town (Flood 2005).

A fourth limitation is handoff, which can only be delivered at walking speeds. Although not a problem when compared with WiFi, this limitation means that WiMAX lacks functionality compared to GSM or UMTS.

Because of the immature nature of WiMAX, we choose not to consider this technology in the rest of this research. There is too much uncertainty about the characteristics and performance of this technology. It is however recommended that the development of WiMAX be monitored in the future, more specifically, its applicability for FMC.

3.4.2.5 Wireless LAN versus wireless WAN: the physics of radio waves

A wireless LAN such as WiFi has the ability of transmitting at much higher bit rates than a wireless WAN like GSM. The reason for this lies in the physics of radio waves. Radio signal strength drops off as the square of the distance (and more, depending on specific circumstances). This means that the closer the user is to the antenna, the better the performance of the system. WiFi is used for transmission over a couple of meters. Therefore it

\(^{23}\) http://ieee802.org/16.
can perform at high bit rates. A GSM antenna has to be able to transmit over a distance of many tens of kilometers, so the bit rate is relatively low.

Besides the distance, the frequencies used by wireless LAN and wireless WAN are different also. Wireless LANs transmit at a high frequency. High frequencies can not travel far and can not penetrate structures like the walls of a building. This seems to be a disadvantage of Wireless LAN, but because Wireless LANs are used inside the house, wall penetration is not necessary. Actually this property is an advantage: it helps avoiding interference. The low frequencies of Wireless WANs can travel far and penetrate structures, helping to reach users that are inside buildings while the antenna is outside.

Low frequencies are scarce and therefore very valuable. They are auctioned off in narrow channel width to make sure that a number of operators have the ability to offer wireless WAN services (Hratko 2005).

### 3.4.3 NGN Protocols

#### 3.4.3.1 Mobile IP (3G/WiFi)

Mobile IP is a service enabling layer technology that is particularly suitable for laptop-based data services, because in these services, no voice control is required. Voice requires handover to be seamless, a feature that is not provided by Mobile IP. Mobile IP does enable the laptop to connect to any available access technology like WiFi, GPRS or UMTS, while keeping the same IP address. This technology is readily available and deployment exists in many parts of the world (Hratko 2005).

Mobile IP facilitates the continuity of the data session when the user is mobile, by facilitating handover between disparate networks so that they are not noticeable to users or applications when their IP connection changes (Smith and Meyer 2005). This technology is used in 3G networks like UMTS and is part of the IPv6 protocol. Mobile IP represents an abstraction of an access technology, by hiding specific access network protocols for applications in the application layer of the network (Patil et al. 2003).

#### 3.4.3.2 SIP

The Session Initiation Protocol (SIP) operates in the application layer of the OSI model. SIP can enable sessions of real-time multimedia services in an IP environment. The great advantage is the possibility of transferring an application session between devices. For example, while in a teleconferencing session, a user can pass the session from his laptop in-home to his PDA in the car. For SIP to be used globally, substantial investments in wireless networks are necessary (Hratko 2005).

#### 3.4.3.3 UMA (GSM/WiFi)

The Unlicensed Mobile Access (UMA) standard has been developed by the UMA Consortium, in which a large group of both operators and equipment vendors are represented. The essence of the UMA solution is the tunnelling of GSM protocols from the handset across an IP

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25 Being Alcatel, BT, Cingular, Ericsson, Kineto Wireless, Motorola, Nokia, Nortel Networks, O2, Research in Motion, Rogers Wireless, Siemens, Sony Ericsson and T-Mobile US.
network through a secure tunnel\textsuperscript{26}. This means that all GSM and GPRS services are also available via an unlicensed access technology like Bluetooth or WiFi.

\textbf{Figure 3.13: The UMA solution}

UMA makes seamless handover between the cellular network and unlicensed access technologies possible, enabling the user to use mobile services via a WiFi or Bluetooth connection and a fixed line that establishes the connection to the Public Land Mobile Network (PLMN). The fixed line is an IP Access Network, such as DSL, Cable, FTTH, etcetera.

To implement UMA in a PLMN, a UMA Network Controller (UNC) needs to be added to the network. To the mobile network, the UNC looks just like an ordinary Base Station Controller. Seamless handover between an unlicensed access point and the cellular network works in exactly the same way as when handover takes place between two cells in an existing GSM network. This principle is illustrated in Figure 3.14.

\textbf{Figure 3.14: UMA and GSM/GPRS architecture}

\textsuperscript{26} Motorola White Paper, \textit{Motorola Seamless Mobility Solutions}, \url{www.motorola.com}, February 2005.
UMA is a Layer 2 technology that uses the MNO’s MSC for call control over a GSM or broadband access network (Hratko 2005). When a broadband access network is used, for example a WiFi connection to a DSL line, the GSM voice signaling and bearer is tunneled from the broadband IP network to the domain of the MNO. This makes UMA an ideal technology to complement the MNO’s cellular network with small WiFi cells. This can be useful in places where cellular coverage is poor and needs to be complemented.

UMA seems primarily based on offering mobile services on wireless access technologies. It therefore is not capable of implementing FMC to the extent of the definition that is used in this thesis (section 3.3). According to the definition, every service will be available on any infrastructure. Additional to UMA another technology is needed: IMS.

3.4.3.4 IMS

The IP Multimedia Subsystem (IMS) is an internationally widely accepted standard that facilitates the transition to a horizontal network architecture27. It was first specified by the Third Generation Partnership Project (3GPP/3GPP2), but now other standardisation bodies like ETSI also embrace it. IMS is an IP based technology that is suitable for multiple types of access, including GSM, UMTS, WCDMA, CDMA2000, DSL and WLAN.

IMS introduces functionalities like presence and group list management. Presence means that the user can easily see the status of their friends and acquaintances, for example “available” if the other party is ready to receive a message or voice call, or “busy”, indicating that it is not a good time to initiate a phone call but that a voice message can be left behind by voicemail. Group list management makes it possible to keep a list of friends and acquaintances (or “buddies”, a term that was introduced by Microsoft’s MSN Messenger) and make this list available to any service deployed in the network. IMS has generic mechanisms for keeping group definitions up to date.

UMA and IMS both play an important role in enabling the consumer to use services independent of infrastructure. But how do IMS and UMA relate to each other? The IMS is situated in the service enabling layer, where it facilitates sessions between several users and

Figure 3.15: IMS and GSM/GPRS architecture

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provides services. UMA is a means to connect to the GPRS core through a broadband IP network, which takes place in the transport layer.
4 Current market structure

In this chapter we first describe current market structures of fixed and mobile telephony. Then we analyse which resources are available to who and whether the market parties are able to obtain the resources necessary to offer FMC.

The market shares mentioned in this chapter are derived from the draft decisions on the retail markets for fixed and mobile telephony by OPTA. Most market shares are presented with a certain margin, considering the confidentiality of the actual figures.

4.1 Structure of the market for fixed telephony

The former state-owned telecom operator KPN that is now privatised, is known as the incumbent operator. KPN is the owner of the Public Switched Telephone Network (PSTN), including both the glass fibre backbone and the twisted pair copper wire to every home. Being a former monopolist on the market of telephony, the incumbent has been subject to regulation ever since the privatisation of the company. KPN not only has a fixed telephony division, but also a mobile division.

On the market for fixed telephony, KPN offers both traditional fixed telephony using the Plain Old Telephony System (POTS), and VoB and VoDSL using its broadband network based on DSL. Cable companies are also capable of offering fixed telephony. Generally, cable companies own a network in a geographically limited area. The networks of the cable companies are rolled out up to the residents of the customers (in other words, they have both a backbone and a network in the local loop). The three cable companies that are by far the biggest in the Netherlands are Essent, UPC and Casema. About 1 to 5 percent of retail fixed telephony traffic is provided by cable companies.

DSL providers that own a fixed network, using a broadband connection to offer fixed telephony, do not own a network in the local loop but only a glass fibre backbone. To deliver their services to the houses of the customers they rely on the copper wires owned by KPN. Broadband services are delivered over these copper wires by means of xDSL. In the Netherlands, next to KPN Retail, Tiscali, BBned and Versatel have their own IP backbone. All they need from the incumbent KPN is access to the copper wire through the Unbundled Local Loop (ULL). Because of the premature nature of the DSL providers’ entrance to the market of fixed telephony, market shares at this moment are not known but are expected to still be very small.

The retail market for broadband internet access is effectively competitive. OPTA has not found significant market power with respect to KPN. KPN’s current market share is 44%. However, KPN is disciplined by competition from cable companies, who have a market share of 40% on the market for broadband internet access, and from alternative DSL-providers. Their current market share is 16%.

Carrier (Pre-) Select (CPS) operators are providers of traditional analogue telephony. Due to regulation these operators have access to the PSTN of KPN to provide their service. Carrier Select means that the user dials a carrier-select code before dialing the phone number. The phone call is then being made via the corresponding Carrier Select operator which will also send the bill. Carrier Pre-Select means that the user can make its choice for a specific carrier.
select operator in advance. Then no carrier-select code has to be entered and every phone call is being served by the chosen CPS operator. In total, there are about 35 C(P)S operators active, of which Tele2 is by far the largest, followed by Pretium Telecom, Scarlet and Budget phone. About 20 to 30 percent of retail fixed telephony traffic is provided by C(P)S operators.

In its draft decisions, OPTA has decided to obligate KPN to offer Wholesale Line Rental (WLR). This means that C(P)S operators will no longer depend on the customer’s subscription to KPN, but that they can sell subscriptions to telephony on the PSTN themselves. This improves the C(P)S operators’ position on the market for fixed telephony.

Considering the criteria identified by Chamberlin, Mason, Bain and Shepherd (section 2.1), we can qualitatively assess the level of concentration within the fixed telephony market. The market is characterised by the presence of an incumbent with SMP. The incumbent is the owner of the copper wire lines in the local loop, a resource that is not replicable by rivals considering the high sunk costs. Regulation has enforced entrance to the market of fixed telephony by imposing remedies on this non-replicable resource. Due to regulation CPS operators have managed to obtain a considerable market share. Product differentiation is mainly based on prices and due to regulation, barriers to entry and exit are low.

4.2 Structure of the market for mobile telephony

Mobile Network Operators (MNOs) are the owners of a cellular network such as GSM or UMTS. Such a network is also called a Public Land Mobile Network (PLMN). As mentioned in the previous section, KPN owns both a fixed and a mobile division. Next to KPN also Vodafone, T-Mobile and Orange are MNOs. Their 2004 market shares are displayed in Table 4.1.

<table>
<thead>
<tr>
<th>MNO</th>
<th>Millions of customers</th>
<th>Market share</th>
</tr>
</thead>
<tbody>
<tr>
<td>KPN Mobile</td>
<td>5.8</td>
<td>39.0 %</td>
</tr>
<tr>
<td>Vodafone</td>
<td>3.5</td>
<td>23.9 %</td>
</tr>
<tr>
<td>T-Mobile</td>
<td>2.3</td>
<td>15.2 %</td>
</tr>
<tr>
<td>Telfort</td>
<td>1.7</td>
<td>11.6 %</td>
</tr>
<tr>
<td>Orange</td>
<td>1.5</td>
<td>10.4 %</td>
</tr>
</tbody>
</table>

Table 4.1: Number of customers and market shares of the Dutch MNOs in 2004

Operators that offer mobile telephony without actually owning a cellular network itself are called Mobile Virtual Network Operators (MVNOs). There are different kinds of MVNOs:

- **Classic Service Provider;**
  - Reseller of the GSM operator offers.

- **Enhanced Service Providers (ESP);**
  - Produces its own SIM cards and controls a few network elements.

- **Full MVNO.**
  - Owns everything except the radio network equipment.

Examples of MVNOs are Debitel, IMC, Scarlet, Tele2, and AH. Most MVNOs are active on the network of Telfort, now owned by KPN.

28 Note that in 2005, Telfort was acquired by KPN.
30 Transatel, [www.transatel-solutions.com](http://www.transatel-solutions.com), June 2005. Transatel is an “MVNO-Enabler”, a service company that provides the tools and services to companies that want to become an MVNO.
Also on the market for mobile telephony we can qualitatively assess the level of concentration. The mobile market is characterised by oligopoly. There are four companies that own a PLMN, which is a non-replicable resource because GSM and UMTS frequencies are auctioned off. In its draft decisions, OPTA considers the mobile market to be competitive to an extent that regulation is not in order. The mobile operators do have SMP on the market for wholesale mobile terminating.

Despite the non-replicability of the PLMN, third parties are capable of entering the market for mobile telephony by becoming an MVNO, which requires relatively low investments. Therefore barriers to entry and exit are low.

Product differentiation takes place based on prices and innovation. MNOs deliver more and more innovative services complementary to telephony, like MMS and other data services.

4.3 Who owns which resources?

Based on the decisive\textsuperscript{31} resources owned by the different market parties, they can be divided into the following categories:

- **The incumbent;**
  The incumbent KPN is the owner of the PSTN. This network covers the whole country and includes the copper wire lines in the local loop. Also, the company owns a PLMN, enabling it to deliver mobile telephony.

- **Cable companies;**
  A cable company owns a geographically limited broadband network that includes the local loop. The three biggest cable companies are UPC, Casema and Essent.

- **DSL providers that own an IP backbone;**
  Next to the incumbent there are three companies that own a fixed network that covers the whole country but does not include the local loop: Tiscali, BBNed and Versatel. These companies have access to the end-users through the unbundled local loop of KPN.

- **Mobile network owners;**
  There are four\textsuperscript{32} companies that own a PLMN. These networks cover the whole country and include radio antennas that enable wireless access. These companies are KPN, Vodafone, T-Mobile and Orange.

- **MVNO;**
  A Mobile Virtual Network Operator uses the radio network equipment of a Mobile network owner to deliver its services. A full MVNO has its own network components to route traffic so it does not completely depend on an MNO for traffic transportation once the traffic is on the network. An Enhanced Service Provider depends on the MNO for traffic transportation. Examples of MVNOs are Debitel, Tele2, Scarlet and Versatel.

- **DSL providers without a network;**
  These companies deliver services making use of the unbundled local loop of KPN. They do not own their own network. Out of a long list examples are Wanadoo and Scarlet.

- **CPS operator;**
  Carrier (Pre) Select operators do not own their own network but deliver their services on the PSTN of KPN. Access to the PSTN is enforced by regulation. Out of about 35 CPS operators Tele2 is by far the largest.

\textsuperscript{31} With decisive resources is meant: those resources that give the company a competitive edge. The emphasis is on the company’s access to either a fixed or a mobile network or both.

\textsuperscript{32} In 2005, KPN has bought Telfort, which brings the amount of MNOs back from five to four.
Note that there are market parties that fit more than one category. KPN is the incumbent owning the PSTN but also is a Mobile network owner and a DSL provider. Tele2 is both an MVNO and a CPS operator. Also other combinations are possible and known.

4.4 The ability to acquire complementary resources for FMC

To be able to offer an FMC proposition a company has to be able to deliver its services through both a fixed and a mobile network. Considering the previous section, it is clear that most of the companies currently active on the Dutch market are not in a position to do so. This section discusses the possibility of the different actors to gain resources in such a way that they can deliver fixed-mobile convergent services. Whether market conduct will be such that these actors actually strive for these resources will be discussed in section 5.3.

Table 4.2 shows which actors require access to which kind of complementary network in order to enter the FMC market.

<table>
<thead>
<tr>
<th>Fixed network</th>
<th>Mobile network</th>
</tr>
</thead>
<tbody>
<tr>
<td>The incumbent</td>
<td>Access already acquired</td>
</tr>
<tr>
<td>Cable companies</td>
<td>Access already acquired</td>
</tr>
<tr>
<td>DSL providers that own an IP backbone</td>
<td>Access already acquired</td>
</tr>
<tr>
<td>Mobile network owners</td>
<td>Access required</td>
</tr>
<tr>
<td>MVNO</td>
<td>Access required</td>
</tr>
<tr>
<td>DSL providers without a network</td>
<td>Access already acquired</td>
</tr>
<tr>
<td>CPS operators</td>
<td>Access already acquired</td>
</tr>
<tr>
<td>New entrant</td>
<td>Access required</td>
</tr>
</tbody>
</table>

Table 4.2: The need of each actor for a complementary network

Again note that some firms fit into more than one category mentioned in Table 4.2. Tele2 is an example of a firm that is both a CPS operator and an MVNO. And now that Tele2 has bought Versatel, it is also the owner of a fixed network.

How can an actor that only has access to a fixed network acquire access to a mobile network? And vice versa, how can an actor that has access to a mobile network acquire access to a fixed network? Access to a mobile network can be acquired by becoming an MNO, by becoming an MVNO or by cooperation with an MNO. Because of the scarcity of low frequencies used by GSM and UMTS (section 3.4.2.5), these frequencies are auctioned off. The scarcity of frequencies, the corresponding high costs of frequency licenses and the fact that this auction is only held once per eight years, makes becoming an MNO virtually impossible for third parties. It is possible to enter the market on retail level and become an MVNO. Entering the mobile market as an MVNO costs approximately 6 to 9 million euro. Since these costs are not extremely high, it can be stated that the costs of entering the mobile market do not form a considerable entry barrier. Entrance to the mobile market by Tele2 (2001), Versatel (2004) and Scarlet (2004) confirm this statement. However, it should be considered that cooperation of a mobile operator is always required when a firm wants to become an MVNO. This is also the case for the third option: cooperation with an MNO.

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33 What is fixed, what is mobile? See section 3.1.
34 OPTA’s draft decision on the market for retail mobile telephony, March 2005.
Access to a fixed network can be acquired considerably more easily. An MNO, MVNO or new entrant has several options: building an IP backbone and becoming a DSL provider, becoming a CPS operator or cooperating with a fixed network owner.
5     Changing market structure as a result of FMC

In the previous chapter we have discussed the current market structures of fixed and mobile telephony. The technological developments enabling FMC have its impact on the telecommunications industry. In this chapter we analyse the changes in market structure, market conduct and market performance as a result of these technology changes. First, we describe how customer demand is expected to shift towards functionality offered by FMC. Then, we analyse the opportunities and threats that FMC presents to the market parties in the telecommunications industry. As a result, market parties will develop new strategies in order to cope with these opportunities and threats. We show that FMC is a desirable strategy that is most likely to meet the customer’s desires. Due to the new strategies, the industry evolves towards a more horizontal structure. Product differentiation is no longer primarily based on infrastructure but on innovative services. Finally, we assess the impact of these developments on the performance of the market.

5.1 Customer demand as an incentive to acquire complementary resources for FMC

The overall interest of the customer is best described by Hratko (2005): Better connectivity by always utilising the best available radio signal for that time and place.

Important additional benefits of FMC are:

- **Personal numbering:**
  The customer can be reached at a single phone number.

- **Single bill:**
  The customer receives a single bill for both fixed and mobile telephony.

- **Reduced costs:**
  Phone calls at home or near a hotspot are made at fixed line tariffs or a user profile is used resulting in a tariff somewhere between fixed and mobile phone call tariffs.

- **Single device:**
  The customer can use a single device, whether connected fixed or mobile, with one address book (see article).

- **One-stop-shopping.**
  The customer enjoys the ease of selecting one supplier for both fixed and mobile services.

5.2 The market parties’ opportunities and threats of FMC

In this section, per actor an analysis is made of the opportunities and threats of FMC.

The incumbent

One of the key drivers to move towards FMC is Fixed Mobile Substitution (FMS). While the number of mobile connections is increasing, the number of fixed connections is declining. This traffic migration is the result of the increase of substitution between the two services as it is

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"The North-Korean leader Kim Jong-il has a phenomenal memory. The Head of State knows the phone number of every worker in his country, since every morning he gets up early to train his memory, is the report of a North-Korean website. The article on the dictator is the latest product of the extensive North-Korean propaganda machine. Earlier articles reported that Kim Jong-il had hit eleven "holes-in-one" at a golf course. Next to leading his country the Head of State is said to fly jets and make operas and movies.". De Telegraaf, August 2005, freely translated into English by the author.
perceived by the customer. The prices of mobile phone calls are increasingly comparable to those of fixed phone calls. Also, the bandwidth available with a mobile phone is increasing, decreasing the competitive advantage of the fixed operators.

Not only the number of connections shows traffic migration. Also the number of minutes called per connection increases for mobile phones and decreases for fixed phones. This indicates that the consumer often chooses to make a phone call with a mobile phone, when also a fixed line is available. In figure 4 this trend can be recognised in the fixed and mobile ARPUs of KPN. It should be noted that the changes in revenues are not entirely caused by FMS. Other causes are the rise of broadband internet at the expense of dial-in internet and the introduction of VoIP. Still, considering the increase of broadband mobile services, further traffic migration from fixed to mobile is expected if no actions are taken.

From the incumbent’s point of view, owning both the PSTN and a mobile network, traffic loss on the PSTN due to FMS can be compensated by extra income from the mobile network. Naturally, a part of the customers lost by the fixed division, replace their PSTN subscription with a mobile subscription at KPN’s mobile division. On the long term however, it will not be possible to compensate the loss of fixed phone subscribers with increased income from the mobile division, because subscribers migrate to other mobile network operators as well.

36 Source: Quarterly reports KPN.
On the short term, FMC has no clear benefits for the incumbent. Offering a bundle of fixed and mobile telephony at a lower price means that benefits decrease. When a bundle is offered at the same price or even at a higher price (section 8.3.2), the question is whether the investment in the network or in the organisation will be worth the effort. Also, offering the possibility of increasing the number of minutes called over a fixed line instead of a mobile network, means that customers will make their phone calls at the relatively low fixed line tariff. On the short term this might not be beneficial for the incumbent, since it will lose traffic on its own mobile network also.

However, on the long term FMC could be a good option for KPN to differentiate its services from its competitors’ and gain a competitive edge. The benefits for the consumer are clear and when traffic on the fixed line diminish due to FMS, FMC seems an effective way to regain market share.

**Fixed network operators**

Like KPN, operators that only own a fixed network such as cable companies and DSL providers will pursue FMC. Generally, they see FMC as a way to extend their services to a larger consumer base and to complete their “multiple play” offer to the customer. Several fixed operators are planning to offer mobile telephony through an MVNO construction at the end of 2005 or early 2006.\(^{38}\)

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\(^{38}\) These estimations are based on the interviews with market parties.
Fixed-mobile convergence, regulatory implications

opportunity to extend the new voice services via cable or xDSL onto the mobile telephony market. The way to accomplish that is through Fixed-mobile convergence.

A CPS operator offers fixed telephony. It could expand its services to the mobile market by becoming an MVNO. Integration on the organisational level is a possibility (i.e. one bill, one-stop-shopping), as is bundling fixed and mobile telephony. Network integration is not an effort that a CPS operator can make by itself, since it has no network of its own and therefore depends on the wholesale offers of KPN.

Mobile network operators
FMC is in some ways the opposite of fixed-mobile substitution (FMS): the data traffic that is now increasing on mobile networks will possibly decrease due to FMC. The reason for this is the possibility for the customer to call over a fixed line when a WiFi hotspot is nearby. In-door traffic that is increasingly handled by mobile operators due to FMS, can be re-claimed by fixed operators through FMC.

Some MNOs are naturally keen on increasing traffic on their mobile network, thus stimulating FMS. A logical response can be seen in the Homezone and Genion projects in Germany by respectively Vodafone and O2. In these propositions, the customer pays local (fixed geographical) tariffs in the area in and nearby the resident. The connection however, is still mobile.

Based on the interviews, some mobile operators are expected to maintain their strategy to stimulate FMS. Some however see FMC as an opportunity to differentiate their services from those of their rivals. Additionally, they can see the opportunity of offering an MVNO construction to fixed operators pursuing FMC, thus creating new sources of income. Offering mobile network capacity is a means to reach a broader customer base.

An advantage of FMC that seems contradictory is the reduction of the amount of traffic on the PLMN. Mobile operators often experience shortage of capacity on their network, thus reducing the performance of their services. The performance of UMTS is rather disappointing compared to the initial expectations of the technology. Mainly the fact that bandwidth reduces linearly with the amount of users that occupy a single UMTS antenna has caused this disappointment.

Offering an alternative in the form of an FMC proposition, a great part of the broadband traffic can be handled by other access technologies than UMTS, thus reducing the intensity of UMTS usage and increasing the performance of the network.

Offering a part of the total voice traffic through a fixed network instead of the mobile network, could also be accompanied by considerable cost savings. These savings could fall to the benefit of the operator itself or could be offered as a discount to the customer.

For the mobile operators, fixed-mobile substitution is a development to be encouraged. Their ARPU increases and the number of mobile subscriptions rises. Nevertheless FMC presents them some major benefits, such as offering better service to the customer by creating the possibility of calling at a lower cost, and the opportunity to reach a broader audience with the services they provide for. In addition, the penetration level of mobile telephony will reach saturation in approximately 2007. This means that a mobile operator has to distinguish itself from its competitors to maintain or increase its share of the voice communications pie. Also, for some operators FMC can present a solution for capacity problems on the PLMN. Therefore mobile operators generally acknowledge the opportunities of FMC and the competitive edge it
will give them if they are the first to offer it to the customer. However some MNOs maintain a mobile-only strategy in order to stimulate fixed-mobile substitution for as long as there are no FMC services yet to compete with this strategy.

The MVNO’s reasoning considering FMC is similar to that of an MNO.

### 5.3 Market parties developing new strategies

In section 5.2 it has become clear that not all market parties pursue FMC. There are even market parties with strategies that seem contradictory to FMC.

Derived from the technical analysis (section 3.4.2.5), we summarise the most important differences between a fixed network with Wireless LAN and a mobile network with Wireless WAN in Table 5.1.

<table>
<thead>
<tr>
<th>Wireless LAN (WiFi)</th>
<th>Wireless WAN (GSM/UMTS/HSDPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High bandwidth</td>
<td>Relatively low bandwidth</td>
</tr>
<tr>
<td>Low coverage area</td>
<td>High coverage area</td>
</tr>
</tbody>
</table>

Table 5.1: Main differences between Wireless LAN and Wireless WAN

When comparing a fixed broadband connection over WiFi and a mobile connection over UMTS, there is a number of major differences. The most important differences are the high degree of mobility of UMTS compared to WiFi and the high bandwidth that is available on WiFi compared to UMTS (section 3.4.2.5). The future strategies of fixed and mobile operators primarily depend on market demand. If the customer appreciates mobility over bandwidth, mobile operators could try to substitute fixed telephony completely. If bandwidth is appreciated over mobility, fixed operators could try to completely substitute mobile telephony. If a combination of mobility and bandwidth is demanded, it is expected that FMC will become a dominant strategy.

The characteristic of WiFi having low coverage, is based on the relatively high frequencies that it uses (section 3.4.2.2). WiFi frequencies can not pass through buildings or other obstacles and can only be sent within short range. Therefore it is unlikely that there will be full coverage of hot-spots in the Netherlands in the next six years\(^\text{39}\).

The difference in bandwidth available with either WiFi or UMTS is described in section 3.4.2.

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In Figure 5.3 we illustrate the bandwidth and the coverage area of the different relevant technologies.

![Graph showing bandwidth and coverage area of different technologies](image)

**Figure 5.3: Bandwidth and coverage of the different technologies**

We make a clear distinction between the terms coverage and mobility. The coverage area of a radio technology is the area that a single antenna can serve. Mobility not only includes coverage but also includes the possibility of handover to an adjacent antenna and thereby the possibility of travelling large distances while maintaining a connection to the network. Note that in Figure 5.3 the coverage area of the technology was determined and that in the following figures in this chapter mobility is decisive.

Based on the characteristics of the two available technologies, the market parties make a trade-off between mobility on one side and bandwidth on the other. This results in four possible strategies. Table 5.2 explains.

<table>
<thead>
<tr>
<th>Coverage area</th>
<th>Relatively low bandwidth</th>
<th>High bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Status Quo</td>
<td>Hotspot Extravaganza</td>
</tr>
<tr>
<td>High</td>
<td>Mobile Only</td>
<td>FMC</td>
</tr>
</tbody>
</table>

*Table 5.2: Four strategies based on coverage and bandwidth*

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40. The bandwidth illustrated in this figure is not the theoretical maximum bandwidth, but the bandwidth as experienced by the user (see also section 3.4.2).
Below, the main properties of each strategy are described:

1. **Status Quo** The name of this strategy intentionally implies standing still. In case of a fixed network owner, it means to continue offering high bandwidth connections without adding mobility (i.e. not investing in WiFi or WiMAX). In case of a mobile network owner it means to continue offering low bandwidth connections with high mobility (i.e. not investing in UMTS and HSDPA).

2. **Mobile Only** As explained in section 5.2, some mobile operators are not pursuing the convergence of fixed and mobile networks. They do not want to lose traffic on their own infrastructure and therefore strive for a scenario in which mobile telephony has completely substituted fixed telephony (fixed-mobile substitution). This strategy is called Mobile Only. The market parties that pursue this strategy will upgrade their Wireless WAN infrastructure with UMTS and HSDPA to deliver their services to the customer with increased bandwidth.

3. **Hotspot Extravaganza** Some fixed operators are recognising that the fixed market is shifting towards mobile. VoIP introduces nomadic characteristics, WiFi adds some mobility and the prospect of WiMAX is mobility of the kind that could substitute mobile telephony. This strategy will be called Hotspot Extravaganza. It means that the market party chooses to upgrade its fixed infrastructure with Wireless LAN technology.

4. **FMC** Operators with this strategy will strive for a situation in which they are able to reach their customers through any possible infrastructure, both fixed and mobile. It can be expected that these companies will pursue acquisition of operators that complement their current operations. An example can be seen already in the Netherlands: the acquisition of Versatel by Tele2. This scenario is called FMC.

It seems that the success of each strategy depends on the following uncertainties:

- Will the customer ask for full mobility?
- Will the customer, while on the move, have bandwidth requirements exceeding the bandwidth available with GSM or UMTS?
We put the four strategies into perspective in Figure 5.4.

**Figure 5.4: Strategies for fixed and mobile operators**

The “final frontier” indicates where status quo ends and the other, more opportunistic strategies begin. In order to keep up with market developments and customer demand, market parties will at least have to cross this barrier.

The possible strategies of the market parties are closely related to what they expect will be the future developments in the telecommunications market. Will the fixed and mobile networks converge and jointly bring services to the customers? Or will mobile telephony with UMTS completely substitute fixed telephony and make the current fixed networks abundant? Or will Bluetooth and WiFi offer a better solution to the customer than mobile networks can?

Figure 5.4 shows the mobile and fixed operators’ current strategies. Mobile network operators try to increase the bandwidth available on their mobile networks in their effort to meet customers’ demand. Looking at Figure 5.3, it becomes clear that with current technologies, MNOs will not be able to offer bandwidth that is comparable to the bandwidth offered on fixed networks. Fixed network operators in turn, try to add mobility to their networks by adopting Bluetooth and WiFi. Again looking at Figure 5.3, we see that the fixed network’s coverage increases, but that actual mobility can not be offered.

Analysing Figure 5.4, it is clear that the customers’ desires are crucial for future developments. As the need for high bandwidth grows, it is becoming more likely that future demand will tip towards WiFi, i.e. scenario Hotspot Extravaganza. As the need for mobility grows, it is becoming more likely that future demand will tip towards UMTS, i.e. scenario Mobile Only. Only scenario FMC can offer the customer both a high level of mobility and high bandwidth.
Considering the likeliness that customers will demand more bandwidth and increasingly value mobility, we conclude that an FMC strategy is the only strategy that actually meets customer demand. Our analysis shows that market parties will opportunistically seek for partners that complement their current resources or that they will expand their resources by innovation.

5.4 Evolution towards a horizontal market structure

The structural tendency that is expected is market parties primarily gaining access to a complementary network by acquisition of a company that has access to that complementary network.

Based on the opportunities and threats of FMC for the different actors (section 5.2), FMC will most likely be initiated by fixed operators and one mobile operator seeking first mover advantage. More mobile operators will follow once FMC services pick up and customer demand tips towards FMC.

In order to be able to offer FMC services, fixed and mobile operators will team up to become the suppliers of (general) telephony services. This will result in a number of horizontally integrated companies that compete on several levels. Next to these horizontally integrated companies there will still be companies offering fixed or mobile telephony only. Competition will be mainly based on the services provided by the companies.

5.5 Product differentiation through innovative services

The market evolving towards a more horizontal structure, where voice operators are present that offer voice services through both fixed and mobile infrastructures, will have an impact on market conduct. Innovation will be increasingly important, since the functionalities bandwidth and mobility are offered by several competitors on a variety of infrastructures. The way market parties can differentiate their services is no longer by offering the same services on a specific infrastructure, but by offering newer and more innovative services than their competitors.

5.6 Changing market performance

When the fixed and the mobile market converge, it is possible to offer the same services through several infrastructures. This means that the number of players able to deliver these services increases and market concentration decreases. According to the SCP paradigm, when market concentration decreases market performance increases. In this thesis, market performance is measured by prices, diversity, quality, and innovation.

Considering market performance, by pricing trends we mean the justifiability of the price level relative to the service delivered. The easiest way to assess pricing trends is by comparing the price of a service with its cost price and to assess whether an exorbitant profit margin is maintained.

Since through FMC more companies are able to deliver connectivity with high bandwidth and a high degree of mobility, it can be expected that competition will primarily focus on price levels and service variety and quality. Therefore market performance is expected to increase.

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41 This expectation was confirmed by the majority of the market parties interviewed.
It should be noted that this expectation will only hold given the right regulation. First and foremost, regulatory conditions should be such that companies are able to extend their resources to a level at which they can deliver FMC services. This asks for a light regulatory approach where innovation and timely investments in infrastructures and services are not needlessly discouraged by the regulatory environment (Rosenstok and Vrijmoet 2005). On the other hand, potential impediments to competition could arise that do require intervention from the regulator. The following chapter describes the New Regulatory Framework in which OPTA operates. Then in Chapter 7 we analyse the possibility of changing market definitions as a result of FMC. In Chapter 8 we discuss the regulatory challenges as a result of FMC, which could ask either for intervention or for regulatory withdrawal.
6 The New Regulatory Framework

The way the Dutch National Regulatory Authority (NRA) OPTA regulates the telecommunications industry is prescribed by the Telecommunications Act. The activities of OPTA can be divided into two main tasks:

- **Supervise compliance with legislation and regulation in the area of electronic communications;**
  The legislation and regulation that is meant here is to be complied with by every provider of a public electronic communications service. In particular, this involves the New Telecommunications Act and European legislation. The generic end-user obligations of the Telecommunications Act are of particular importance for this research and therefore are prominently present in the description of legislation in section 6.1.

- **Impose remedies on a market where a market party with significant market power is present, in order to promote competition and giving consumers more choice and fair prices.**
  These remedies are obligations that can only be imposed on market parties with SMP. Therefore these obligations are called asymmetric regulation. There is a specific procedure that OPTA has to follow in order to impose remedies. This procedure is described in section 6.2.

These two primary tasks of OPTA are represented in Figure 6.1.

![Figure 6.1: Primary tasks of OPTA](image)

In the following sections these primary tasks are discussed.

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42 Supervision of compliance with legislation and regulation in the area of postal services also belongs to the tasks of OPTA. Considering the subject of this thesis however, this will be left aside.
6.1 Symmetric regulation
In this section the most important legislation and regulation that OPTA supervises is discussed. This legislation and regulation applies to all providers of a public electronic communications service.

6.1.1 Generic end-user obligations of the Telecommunications Act
The new Telecommunications Act of May 2004 serves as the foundation of OPTA’s activities on the telecommunications market. In the Telecommunications Act, a number of articles have the purpose to protect end-users and to obligate the providers of an electronic communications service to provide this protection. These obligations are imposed in several areas, among which are number portability, the provision of relevant information to the subscriber and the availability of the emergency service number. The complete list of generic end-user obligations in the Telecommunications Act is presented in Appendix E.

6.1.2 Interconnection
Another important obligation for all providers of a public electronic communications service is interconnection. Providers, both fixed and mobile, are obligated to interconnect their networks in order to enable end-users to make a phone call to every other end-user, regardless of the networks that are used.

6.1.3 European legislation
An NRA has to take into account the European legislation on telecommunications networks and services, in order to ensure harmonization and legal security. Also, an NRA has to comply to the “ERG Common Position on the approach to appropriate remedies in the new regulatory framework”, as composed by the European Regulators Group (ERG), in which all European NRA’s are represented.

6.1.4 Relation to theory
Most of the legislation that forms the foundation of the symmetric regulation of OPTA is derived from the SCP market paradigm. The generic end-user obligations of the Telecommunications Act are meant to influence the conduct of the providers of an electronic communications service. The choice to intervene with the market parties’ behaviour is based on the assumption that the conduct of these actors determine the performance of the market. In other words, it is assumed that competition can be promoted by restraining the market parties’ conduct.

An example is interconnection, which obligates all providers of a telephony service to make their network interoperable. In doing so, consumers are able to make phone call to anyone, independent of the telecommunications provider that the receiving party is connected to. Enforcing interconnection is an instrument that strongly influences market conduct.

6.2 Asymmetric regulation
The Telecommunications Act states that market analyses have to be performed in order to define markets on which market ex ante regulation can be imposed. The European Commission (EC) has formulated eighteen markets for the regulator to analyse. These markets are listed in Appendix A. In the period from February until June 2005, OPTA has determined whether these markets are susceptible to ex ante regulation in its so-called Draft Decisions. At the moment of

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43 Telecommunications Act, Chapter 6.
writing this thesis, these documents are notified to the European Commission and pending on the Commissions approval. Nevertheless, the draft decisions give a clear view of the way OPTA will regulate the telecommunications industry, at least in the three years to come.

OPTA can add a market to this list if it can persuade the European Commissions Article 7 Task Force that this market passes three tests:

- The market has substantial and non-transitory barriers to entry;
- The market is not tending to a state of effective competition within a relevant time horizon;
- Competition law alone is not adequate in dealing with these competition problems.

In order to assess whether obligations should be imposed on a market party with SMP on a particular product market, the product market has to be defined first. Second, a market party with Significant Market Power (SMP) has to be determined on the defined market. Third, the NRA determines whether intervention is necessary. In other words, do problems occur in the market that can and must be solved by remedies from the regulator? And finally, which remedies are appropriate and adequate in dealing with these problems? Figure 6.2 explains.

![Diagram](image_url)

*Figure 6.2: Regulatory process for determining remedies*[^15]

Not only is this process used to assess which remedies are to be imposed on a particular market, it is also used to evaluate the current remedies that are in place and to decide whether regulatory withdrawal is possible.

[^14]: Using this option, OPTA is in the process of adding a nineteenth market to the list of eighteen: the retail market for cable. In the Netherlands, the penetration of cable is high relative to that of other European countries.

In the following sections, the considerations of OPTA in taking each step are discussed.

6.2.1 Defining the market
The first step is to define a relevant product market. A relevant product market contains all products that have the same function in the opinion of the consumer and therefore are each others substitutes. To assess whether products are substitutes, the following question is asked: will customers, in case of an increase in price of product A, switch to purchasing product B instead? If the answer is positive, products A and B are substitutes. However, this approach presents a problem: as the increase in price of product A becomes bigger, also the number of products that the consumer perceives as a substitute will increase.

As an illustration consider calling someone with a fixed phone opposed to stepping on a bike to personally come in contact with the other person. If the price of fixed telephony would increase with a small proportion, virtually no consumer will consider buying a bike instead of a phone. However, would the increase in price be enormous, say ten euro per minute, a considerable amount of consumers will buy the bike as a substitute for fixed telephony. Fixed telephony and bikes would then be part of one product market.

To overcome this problem, NRAs use the SSNIP test to define a relevant product market. The SSNIP test defines the increase in price as being small but significant. This prevents from unintentionally adding a product to the relevant market. In practice, a 5 to 10 percent increase in price is used.

Additional to the product market, also the geographical market has to be defined. Does the consumer only consider the products within the boundaries of the country? Or does the market have to be defined more broadly, for example all relevant products within Europe?

6.2.2 Determining SMP
The second step in the asymmetric regulatory process is to define markets on which market parties with Significant Market Power (SMP) can be identified. Obligations can be imposed on these parties in favour of competition. Since the New Telecommunications Act of May 2004 became effective, the method used by the NRA to determine a party with SMP has become similar to the method used by the competition authority. In determining significant market power, not only market shares, but also price developments, the barriers to entry and exit, the ability of customers to switch between providers and shifts in market shares are considered. Main point is that a market party with SMP can behave independently of other market parties or external influences within the relevant market. In its market analyses, OPTA does consider a market share of 50 percent or more to be an important indicator for SMP.

6.2.3 Determining whether intervention is necessary
The third step in the regulatory process is to analyse whether intervention by the NRA is necessary. The primary goal of an NRA is to accomplish a situation in which sustainable and effective competition is present. Ideally, competition would remain sustainable and effective without the need for a sector-specific regulatory authority. In order to achieve such a situation, an NRA can choose to intervene in a market. Whether intervention is needed is determined by the height of the barriers to entry, the ability of potential competitors to replicate the products or services within the relevant market and the level of competition within the market.
6.2.4 Determining remedies
If in the third step the conclusion is drawn that intervention is necessary, the NRA has to
determine which remedies are best fit to deal with the competition problems.

To promote competition, obligations can be imposed within the following areas:
- **Access to networks;**
  Requires the network owner to allow other providers to offer services on its network.
- **Transparency;**
  Obligates the operator to provide the customer with relevant information about the tariffs it uses.
- **Non-discrimination;**
  Prevents the operator from treating third parties in a different matter than its own subdivision, or from charging different prices.
- **Tariff regulation.**
  Enables market parties to compete with the party that has SMP, by regulating interconnection and end-user tariffs.

6.2.5 Relation to theory
The procedure of defining a market and determining SMP is derived from SCP theory. The
procedure is based on the assumption that influencing the structure of the market alters the
behaviour of the market parties which in turn determines the performance of the market. This
emphasis on market structure becomes even more clear when the way of determining SMP on
a market is analysed. Interesting to see is that the way SMP is determined has shifted from a
market structure point of view towards a market conduct point of view. In the old regulatory
framework, determining SMP was primarily based on market shares. In the NRF, a market party
with SMP is described as a party that can behave independently of other market parties or other
external influences within the relevant market, thus shifting the aim of the methodology from
market structure to market conduct. The SCP approach however can still be clearly seen in the
fact that OPTA considers the presence of SMP to be very likely when a market share of 50
percent or more is observed.

The shift of focus towards the companies behaviour can also be explained as being a shift
towards the RBV paradigm. No longer the focus is primarily on market shares, but instead on
the ability of the company to behave independent of its competitors. The company derives this
ability from its access to a resource that gives the company a competitive advantage. If other
companies were to have access to this resource as well, the ability of the company to behave
independently of others would diminish.

The third step in determining remedies, determining whether remedies are necessary, is
primarily based on the SCP paradigm. The existence of entry barriers is a clear indication for
hampered competition. The idea of solving entry barriers is derived from the SCP market
paradigm. Solving an entry barrier enables third parties to enter the market, thus altering market
structure. The number of players on the market increases and the relative market shares of the
companies drop. This reduces the individual market party’s possibility of behaving in an anti-
competitive matter and increases product or service variety available for the consumer.

The possible remedies that OPTA can impose on market parties show a relationship with both
the SCP theory and the RBV theory.
Remedies within the area of access to networks (one-way access) are meant prevent exclusive behaviour by the market party with SMP. Although an SCP point of view is clearly present, there is a strong presence of the RBV theory here as well. The ability of a company to exclude third parties from using its network is determined by its exclusive access to a resource. In case of FMC such a resource can be the provider’s network and, through its network, the provider’s access to its subscribers. Enforcing access gives third parties the possibility of using the subject’s resource which otherwise would enable the company to raise barriers to entry that could considerably hamper competition.

Holding information back is a type of anti-competitive conduct that could be applied by a market party with SMP. Transparency is enforced in order to prevent this and inform the consumer of the prices and quality of the services offered by the provider. This enables the consumer to choose the provider that best fits its needs.

Non discrimination prevents possible behaviour of market parties with SMP such as charging excessive wholesale prices with the goal of exclusion. This remedy therefore intervenes in the conduct of market parties. A result of this intervention is enabling firms to enter the market, thus increasing the number of firms active in the market and decreasing concentration.

Remedies within the area of tariff regulation clearly restrain the conduct of the players on the market, in this case to set prices in an anti-competitive way.
7 Changing market definitions as a result of FMC

Now that we have presented the expected changes in market structure and we have described the way OPTA regulates the market, in this chapter we will discuss the implications of these changes on the market definitions used by OPTA. Note that in this thesis, the geographical aspect of market definitions is not assessed. The emphasis here is on the definition of the relevant product markets.

7.1 How an NRA defines markets: the SSNIP test

When defining whether two products are part of the same relevant product market, the regulator uses the SSNIP test. This test is a thought experiment in which a hypothetical monopolist imposes a small but significant increase in price. If this results in an increase of profit it can be stated that the hypothetical monopolist can behave without experiencing effective competition from outside the market. In that case the market can be defined as a relevant market. In contrast, if the prices of products from outside the market exert competitive pressure and thereby constrain the behaviour of the hypothetical monopolist, these products should be included in the relevant market and the market is defined more broadly.

In case of phase one of FMC, the bundle of fixed and mobile telephony, substitutability of both the bundle and a fixed connection and the bundle and a mobile connection must be assessed. The corresponding question is: if a hypothetical monopolist on the market for the bundle raises its prices with 5 to 10 percent, will there be a disciplinary response of the market as a result of customers substituting the bundle for fixed or mobile telephony? If that is the case, the bundle in itself is not a separate relevant market. If there is no disciplinary response, FMC can be defined as a relevant market apart from the markets for fixed and mobile telephony.

The SSNIP test must also be applied in the other direction. If the price of one of the components of the bundle increases with a small but significant proportion, will enough customers substitute the component for the bundle to prevent the hypothetical monopolist from increasing its profit? If this is the case, the component belongs to the same relevant market as the bundle.

The same exercise must be applied to phase two of FMC: FMC with network integration. Because the characteristics of the product have changed due to added functionality, the behaviour of the consumers could also be different. So again the question is: what is the response of the customers in case of an increase in price with 5 to 10 percent of either the bundle or one of the components of the bundle and what does this mean for the market definitions.

46 SSNIP stand for Small but Significant and Non-transitory Increase in Price.
47 The SSNIP test was originally developed in the USA as a tool for market definitions in merger cases, see Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines, 1982.
7.2 Current market definitions
In the provisional market analysis of retail fixed telephony of July 2005, OPTA analyses whether fixed and mobile telephony belong to a single market definition. This is the case when mobile telephony presents a substitute for fixed telephony and when the SSNIP test confirms.48

In its analysis, OPTA recognises two primary differences between fixed and mobile telephony: functionality and tariffs. Although mobile telephony has the advantage of mobility, the relatively high price and the necessity of having a fixed line for broadband internet convince the majority of the consumers to maintain their fixed line. This added value of the fixed line convinces 90 percent of the consumers to keep the fixed line in addition to their mobile phone.49 The fact that many users subscribe to both fixed and mobile telephony is an indication that the products are not substitutes. This dismisses the argument of several market parties that FMS is an indication that fixed and mobile telephony are substitutes and therefore belong in a single relevant market. The number of customers substituting fixed telephony with mobile telephony is too small compared to the number of customers subscribed to both fixed and mobile telephony.

Generally, mobile telephony is twice as expensive as fixed telephony.50 Tariffs from mobile to mobile are about equal to those from fixed to mobile. A price difference of two products does not necessarily mean that the products belong to separate product markets. The question remains: would a small but significant (5 to 10 percent) and non-transitory increase in price of fixed telephony result in a significant amount of users switching to mobile telephony? Considering the price difference of the two products, an increase of 5 to 10 percent is not expected to result in a significant amount of switching customers. Figures from price developments of the last years confirm this suspicion. KPN has increased its fixed line tariffs with about 10 percent in the last two years. This increase in price was followed with a decrease of subscriptions of 1 to 5 percent. This decrease is too small to be considered significant in a SNIPP test. Also, a decrease of the number of fixed line subscribers could be explained by other factors than the increase in price.

Based on the analysis described in this section, OPTA has decided that fixed and mobile telephony are not substitutes and belong to different markets.

7.3 Possibility of defining one product market for both fixed and mobile telephony
As described in the previous section, OPTA applies a distinction between fixed and mobile telephony based on the difference in functionality and prices. Consequently, two relevant product markets are defined. In this section the possibility of defining a single product market for both fixed and mobile telephony in the years to come is analysed. This could be possible if the distinction based on functionality and prices were to disappear.

The distinction based on functionality is derived from the fact that fixed telephony is related to a fixed geographical area while mobile telephony offers mobility. Mobility means the ability to

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48 Note that in the market analysis of OPTA, a possible bundle of fixed and mobile telephony is not considered since at present, such bundles are only offered at a very low scale.
49 Another reason to keep the fixed line is the occasional bad reception of the mobile phone within the house. Also, even with good reception, the voice quality of GSM is low compared to PSTN. The reason for this is the compressing technology used in GSM, decreasing the amount of bandwidth needed at the cost of lower quality.
50 As analysed for OPTA by OVUM, Fixed Mobile Substitution in the Netherlands, Market Research and High Level strategic, in December 2003.
travel large distances while maintaining one’s connection. The distinction based on functionality could disappear when fixed telephony would gain mobility. With the rise of wireless access technologies such as Bluetooth and WiFi, and the nomadic feature of VoIP, it could be argued that fixed networks will become increasingly “mobile”.

However we dismiss this argument, because though a movement towards mobility is acknowledged, true mobility will not be offered by fixed networks. It is not expected that technologies such as WiFi will ever deliver full nation-wide coverage and, additionally, offer roaming and handover to an extent that a connection can be maintained while travelling large distances. Despite the mentioned technologies, telephony via a fixed network remains related to a fixed geographical location.

Another argument to abandon the distinction between fixed and mobile telephony is that retail prices could balance. However, current developments do not indicate such an evolution of retail prices. Though prices for phone calls from one mobile phone to the other are becoming increasingly comparable, they are not expected to reach the low level of fixed to fixed phone calls, even after regulation of the MTA tariffs by OPTA. Moreover, the fact that the mobile terminating tariffs of MNOs are becoming the subject of regulation and therefore are expected to be lowered, MNOs themselves warn that this could have a negative effect on retail prices for mobile telephony.\(^{51}\)

Based on the expected market developments and the corresponding impact on the functionality and prices of fixed and mobile telephony, our analysis is that the distinction between the fixed and mobile market definitions will be maintained, also in the years to come.

### 7.4 Introduction of a new market definition for FMC

The previous section shows that the distinction between the markets for fixed and mobile telephony is likely to remain in the years to come. FMC raises the question whether a new relevant product market can be defined specially for FMC and in addition to the existing relevant product markets for fixed and mobile telephony.

When analysing whether an additional market for FMC can be defined, we consider the two phases of FMC as described in section 3.3. First, we will discuss bundling of fixed and mobile telephony. Second, FMC with integration of the fixed and mobile networks is assessed.

In the first phase, the bundle of fixed and mobile telephony has some benefits for the customer. The customer receives one bill for both services, enjoys one-stop-shopping and will likely be offered a discount compared to the total price of the separate products. Assuming that customers indeed appreciate this proposition, the bundle could earn a considerable market share in the market for voice. This is an alternative to be reckoned with and it has to be considered in the market definitions of the regulator.

In the second phase, the combination of fixed and mobile telephony has the benefit of always utilising the best available radio signal for that time and place, and additional benefits such as roaming between fixed and mobile networks, seamless handover and using one device with one address book and a single phone number. Therefore in phase two, the value of the product

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\(^{51}\) This concern was expressed by two mobile operators in the interviews.
increases and the functionality differs from that of fixed and mobile telephony separately. This could also have an impact on market definitions.

It should be kept in mind that the described phases are ideal situations and that the transition from phase 1 to phase 2 in practice will be gradual. This means that when markets must be defined differently in case of phase 1 than in case of phase 2, the moment in time when the market definitions change should be determined.

7.4.1 Inapplicability of the SSNIP test to assess future market definitions

The SSNIP test can be performed either with a quantitative or a qualitative approach. Performing the SSNIP test quantitatively requires detailed figures on the price levels of the different products involved and the own-price elasticity of the customers' demand for the different products (Png 1998). Also, it is possible to use empirical data from price developments in the past.

Phase 1 is indeed offered to business users52, but at a scale that is too small to exert pressure on the prices of either fixed or mobile telephony separately. Phase 2 is not offered yet in the Netherlands. In the UK an FMC proposition with limited network integration is offered in project Fusion (chapter 1). However, its small scale makes it highly unlikely that the price of this offer exerts pressure on the prices of either fixed or mobile telephony.

FMC and the accompanying bundling of fixed and mobile telephony are of a very immature nature. A test based on measurements is not yet possible. Moreover, now that the first offer of a bundle of fixed and mobile telephony exists, the scale at which the bundle is offered at this stage is too small for its price to actually exert pressure on the prices of the existing offers. Therefore the SSNIP test can not be used quantitatively to assess the accuracy of the current market definitions.

Consequently, there are no empirical figures available to perform the SSNIP test in a quantitative sense at this moment. Also when assessing future development of market definitions the SSNIP test can not be performed quantitatively. The prospective character of this research asks for a qualitative method53 for assessing the impact of FMC on future market definitions.

7.4.2 A qualitative approach to assess future market definitions

As an alternative to the quantitative SSNIP test, we use a more qualitative approach. In order to predict the behaviour of the customer without quantitative input, the following criteria54 are used:

a) The extent to which the products are offered and purchased in a bundle;

We assume that when the products are to a large extent offered and purchased in a bundle, it is likely that there is a separate relevant product market for the bundle. Take for example

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52 For example GRIP, offered by KPN.
53 A possible qualitative method could be to perform a consumer survey. However, performing such a survey is very time consuming. Second, we argue that consumers will hardly be able to predict their behaviour when confronted with a product that they are thus far not familiar with. This makes the outcomes of the survey questionable. Therefore the option of performing surveys as an alternative for the qualitative SSNIP test is rejected.
54 The qualitative approach as described in this chapter is derived from OPTA’s draft decision on the retail market for fixed telephony. In the draft decision, OPTA uses this qualitative approach to assess whether Voice over Broadband and the corresponding broadband internet connection (offered in a bundle) belong to the same relevant product market.
different sections of a newspaper. These sections are to a large extent offered and purchased together. This is an indication that there is a relevant market for the bundle of sections, i.e. the newspaper, instead of a market per section.

b) **The end-user’s perception of the separate products being a bundle;**

When end-users perceive the separate products as part of a bundle and, in the eyes of the end-user, it makes more sense to buy the bundle than to buy the products separately, it is likely that there is a separate relevant product market for the bundle. An example is buying a left and a right shoe. It does not make a lot of sense to buy a left shoe or a right shoe only. The end-user’s perception is that a left and a right shoe naturally belong to a bundle and are to be bought together. This is an indication for a relevant product market for the bundle of a left and a right shoe.

c) **The degree to which the products are complementary, substitutes or independent of one-another;**

If two products are complementary it is likely that an increase in price of the bundle will convince little customers of switching to buying one of the components only. This is therefore an indication that there is a separate relevant product market for the bundle. If the products are substitutes, it is likely that customers can choose to buy one of the components instead of the bundle in case of an increase in price of the bundle. This would indicate that there is no separate relevant product market for the bundle but instead the components and the bundle all belong in one relevant market.

d) **The price difference between the bundle and its components;**

If the bundle is a lot cheaper than the sum of the prices of the components, the components exert little competitive pressure and it is unlikely that the end-user will switch to purchasing the separate products in case of an increase in price of the bundle. Generally, a price difference equal to or larger than 10 percent is used. This price difference is an indication for a separate relevant product market for the bundle.

e) **The extent to which the products are purchased in a fixed proportion.**

A positive correlation between the quantities sold is an indication for a separate relevant product market for the bundle. For example consider a mobile phone and its battery. If two products are generally bought in a fixed proportion, this is an indication that a separate relevant product market for the combination of these products exists.

In this chapter, first the current market definitions as defined by OPTA are described. Second, using the same methodology as OPTA, the market definitions in case of a phase one bundle of fixed and mobile telephony are analysed. Third, the same exercise is applied to phase two of FMC: network integration.

### 7.4.3 Market definitions in case of a bundle of fixed and mobile telephony

In this section, the criteria presented in section 7.4.2 are evaluated in the case of a bundle of fixed and mobile telephony. Because of the premature nature of bundling fixed and mobile telephony, not all of these criteria can be fully assessed.

a) **The extent to which the products are offered and purchased in a bundle**

Although a bundle of fixed and mobile telephony will certainly appeal to a group of end-users, fixed and mobile telephony will still be purchased separately on a large scale. Providers of the bundle will therefore not be able to set a price independent of the separate products, because

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55 OPTA, *Bundling, the economic theory and a framework for ex-ante regulatory assessment*, EPN04, September 2004
the bundle competes with the separate products. In the future, it is probable that the bundle will increase in popularity, but as long as the separate components are purchased in a substantial amount, their prices will apply pressure on the price of the bundle. Based on the extent to which the products will be offered and purchased in a bundle, it can not be stated that there is a separate relevant product market for the bundle.

b) The end-user’s perception of the separate products being a bundle
The expectation that a large group of end-users will still choose to purchase only fixed telephony or only mobile telephony (chapter 5) is an indication that end-users do not perceive fixed and mobile telephony as a bundle. Their choice will be based mainly on the financial benefit of purchasing the bundle.

c) The degree to which the products are complementary, substitutes or independent of one-another
Remember that based on FMS (the tendency of consumers to replace their fixed phone with a mobile phone) it can be argued that fixed and mobile telephony are substitutes. This is in fact the opinion of several market parties. However, as described in section 7.2, OPTA has stated that the number of customers switching from fixed to mobile in case of an increase in price is too small to consider them to be substitutes. Based on functionality fixed and mobile telephony are complementary. Contrary to the other criteria, this is an indication that there could be a market for the bundle.

Considering the expectation that fixed and mobile will still be purchased separately, substitution is expected between the bundle and fixed telephony and the bundle and mobile telephony. This is an indication that the bundle does not belong to a separate product market.

d) The price difference between the bundle and its components
What prices will be set for the bundle of fixed and mobile telephony is not yet known. A bundle without added value of network integration will expectedly be offered with a discount compared to the components. The ability of offering a discount is a result of efficiency due to shared resources like marketing and billing. Nevertheless the price difference will probably not be significant to an extent that the separate products will not be able to compete. Hence this is no reason to define a market for the bundle.

e) The extent to which the products are purchased in a fixed proportion
In the years to come, phone calls initiated on either a fixed or a mobile network will still be billed primarily on a per minute basis. When a bundle is presented on the short term, this will probably still be the case. Flat fee constructions are becoming more and more popular for voice services, but it can be assumed that flat fee offers for both fixed and mobile telephony will not be offered in the years to come, because of the difference between fixed and mobile terminating tariffs. In a flat fee construction fixed and mobile telephony would be purchased in a fixed proportion. As long as this is not the case, this is no reason to define a market for the bundle.

Conclusion
On the short term and based on these criteria, we find little ground to define a separate product market for the bundle of fixed and mobile telephony without network integration.
7.4.4 Market definitions in case of FMC with network integration

The same methodology can be applied to phase two of FMC, a bundle combined with network integration. The characteristics of the bundle have changed due to the added functionality as a result of intelligent networking. This section describes the way markets should be defined consequently.

a) The extent to which the products are offered and purchased in a bundle

FMC with network integration, in the rest of this chapter called FMC, is in terminis a combination of fixed and mobile telephony. This means that when the end-user demands FMC functionality, its only option is to purchase a service in which connectivity with both a fixed and a mobile network is present. This is an indication that there is a market for FMC.

b) The end-user's perception of the separate products being a bundle

When FMC is in a stage of network integration, the bundle has added value in comparison to the separate products fixed and mobile telephony. This added value could initiate a shift of the customer demand towards the bundle, at the cost of the separate products. A user would then make its choice between the several providers of FMC bundles, instead of a choice between the bundle and purchasing the products separately. A result would be that a small but significant increase in price of the bundle would not be disciplined by the prices of the separate products. The market of FMC can then be considered a separate relevant market.

c) The degree to which the products are complementary, substitutes or independent of one-another

When FMC is in a stage of network integration, fixed and mobile telephony will be applied complementary. When the products are complementary, this would imply that there would be a relevant market for FMC.

d) The price difference between the bundle and its components

Consider the extra functionality of FMC compared to purchasing fixed or mobile telephony separately. This extra functionality creates extra value for the product from the perspective of the consumer. When the price of FMC is equal to the sum of the prices for fixed and mobile telephony, the consumer will still choose to purchase FMC. FMC is accompanied by economies of scale and scope that enable the provider of FMC to offer the service with a discount compared to fixed and mobile telephony.

The added value means that once an end-user has switched from either fixed or mobile telephony to FMC, it is very unlikely that the user will ever switch back. Remember the SSNIP test. When a hypothetical monopolist on the market for fixed telephony raises its prices with 5 to 10 percent, customers will respond by switching to FMC. This also applies to a hypothetical monopolist on the market for mobile telephony raising its prices by 5 to 10 percent. In the other direction however, a disciplinary response will not occur! A hypothetical monopolist on the market for FMC will be capable of raising its prices by 5 to 10 percent and increase its profits, because little customers will switch back to fixed or mobile telephony only. The added functionality of FMC creates what is called an asymmetric market\textsuperscript{56}.

\textsuperscript{56} Further reading on asymmetric markets can be found in OPTA, Bundling, the economic theory and a framework for ex-ante regulatory assessment, EPN04, September 2004.
e) The extent to which the products are purchased in a fixed proportion
On the long term, flat fee constructions will become the leading trend. Then, fixed and mobile minutes will be purchased in a fixed proportion, supporting the case for a market for FMC.

Conclusion
In the long term, when full network integration is realised and offering a product in which fixed and mobile telephony are combined has become common, our analysis shows that a relevant product market for FMC could be defined. Note that this does not mean that the markets for fixed and mobile telephony have converged into one market! Instead a separate market for converged fixed and mobile services will be defined next to the existing relevant markets for fixed and mobile telephony.

Whether the existing market definitions will remain relevant depends on the impact of FMC and the extent to which fixed and mobile telephony will be offered next to FMC. The SSNIP test only applies in one direction, meaning that FMC exerts pressure on the prices of fixed and mobile telephony, but the prices of fixed and mobile telephony do not apply pressure on the price of FMC. This asymmetric character of the market, i.e. customers willing to switch to FMC but not willing to switch back, implies that the existing markets for fixed and mobile telephony could diminish in time, leaving behind only the market for Fixed-mobile convergence.

7.5 Determining SMP on the market for FMC
What are the implications of the added relevant product market on regulation? A separate product market for FMC means that on this relevant market, it will have to be determined whether a party with SMP is present.

7.5.1 In case of phase 1: a bundle of fixed and mobile telephony
Since there is no reason to define a separate relevant market for a bundle of fixed and mobile telephony, regulation will be applied using the current market definitions. On the market for fixed telephony, KPN has SMP. This means that the fixed component of the bundle will have to comply to the regulations imposed on the fixed telephony market.

In a sense, this can be considered a limitation. The ability of the regulator to regulate the mobile part of the bundle is constrained because this market is considered to be fully competitive. Hence, no party with SMP is determined on this market. Therefore in theory and without regulation, the incumbent is capable of offering mobile telephony in a bundle with fixed telephony at a price far below cost price. The losses on mobile telephony could be compensated with income from fixed telephony without the regulator being able to detect it, let alone prevent it. This is exactly the concern that is emphasised in the regulatory issue of illegal bundling (section 8.3.2).

7.5.2 In case of phase 2: FMC with network integration
When the market evolves towards a situation in which fixed-mobile integrated services are offered, a relevant product market for these services could be defined. This means that on the new market of FMC a market party with SMP can be determined, based on the ability of a dominant market party to behave independently of other market parties.

The question is whether this is desirable. A common characteristic of a market in its premature stage is the presence of a “first mover”: a market party that enters the market with a new product. In doing so, the first mover risks failure because success depends on customers’
Changing market definitions as a result of FMC demand, which at best can be predicted but never known. It is only natural that a first mover has a large market share and, at least for some time, can behave independently of other market parties. A regulator that reacts to such a new product by immediately restraining the first mover with regulations and remedies to establish competition, risks commercially killing the first mover thus hampering innovation. It could be more appropriate to apply a light regulatory approach.

7.6 Regulatory requirements for a new market for FMC

For the transition towards a new converged market to succeed, we recognise a number of regulatory requirements that have to be met. First of all, the necessity of enforcing access to the network facilities of KPN must be assessed. Second, the entry barriers to the market of FMC must be removed. In the presence of entry barriers, end-users will experience impediments for switching from either fixed or mobile telephony to FMC. Third, possible anti-competitive behaviour from the incumbent must be prevented. Anti-competitive behaviour could result in a dominant position for the incumbent on the new market. During the transition, a fourth task for OPTA is to monitor consumer protection.

Only when entry barriers are taken away and anti-competitive behaviour is prevented, the industry can evolve towards a new competitive product market for FMC. This is desirable because this development presents OPTA with a fifth challenge: possible regulatory withdrawal.

These five regulatory challenges are further elaborated on in the next chapter.
8 Regulatory challenges for OPTA

The emergence of a new market for FMC presents the regulator with a number of challenges. First, the necessity of enforcing access to the integrated network of KPN must be assessed. Second, entry barriers to the market of FMC should be removed in order to establish low concentration on the new market. Third, possible anti-competitive behaviour by KPN should be prevented. Fourth, consumer protection should be monitored and finally, the possibility of seizing the opportunity of regulatory withdrawal should be analysed with respect to FMC.

The regulatory issues listed in this chapter are identified with the help of interviews with market parties and a session in the Group Decision Room (see appendix F and G for more details).

8.1 If necessary, enforce access to specific network facilities

Again we consider the two phases of FMC: bundling fixed and mobile telephony and FMC with network integration (section 3.3). In the first phase convergence has taken place on the organisational level only (section 3.2). For an operator to offer a bundle of fixed and mobile telephony, no technological changes in the network are required.

In phase two convergence has also taken place at the technological level. This means that an operator trying to enter the market for FMC requires both a fixed and a mobile network and the network facilities necessary to offer FMC functionality.

8.1.1 General properties of access obligations

Obligations can be imposed on operators “to meet reasonable requests for access to, and use of, specific network elements and associated facilities, inter alia in situations where the national regulatory authority considers that denial of access or unreasonable terms and conditions having a similar effect would hinder the emergence of a sustainable competitive market at the retail level, or would not be in the end-user’s interest.”57

In the common position58 on remedies of the European Regulators Group, the remedy of enforcing access to a network is considered to be a severe remedy that should only be imposed when a competition problem occurs that other remedies cannot cope with. According to the common position “NRAs need to balance the rights of an infrastructure owner to exploit its infrastructure for its own benefit, and the rights of other service providers to access facilities that are essential for the provision of competing services.” This chapter focuses on the question whether the facilities of KPN are essential for the provision of competing services by other service providers when KPN would offer FMC. Other service providers are fixed-only and mobile-only operators. We will assess this question in each of the two phases of FMC.

8.1.2 Necessity of access in case of phase one

Phase one of FMC, bundling fixed and mobile telephony, is characterised by one-stop-shopping, receiving a single bill, receiving a discount and possibly flat rate or flat fee solutions. Mobile operators have the possibility of offering a product with such characteristics with their...

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58 ERG, Common position on the approach to appropriate remedies in the new regulatory framework, ERG(03)30rev1, April 2004.
“Mobile-Only” solution (for example the Homezone and Genion projects in Germany by respectively Vodafone and O2), assuming that they are capable of offering a discount compared to their current prices. This solution can compete with a bundle of fixed and mobile telephony based on both functionality and prices.

Fixed network operators can not offer mobility with their networks. Therefore they can only offer a service comparable to the bundle offered by KPN in cooperation with a mobile operator. The fixed operator then becomes an MVNO or an Enhanced Service Provider (ESP, section 4.2) on the network of a mobile operator. In section 4.4 we conclude that the barrier to enter the mobile market as an MVNO or ESP is low, given that mobile network operators continue to offer MVNO or ESP services on a wholesale level. If not, wholesale access regulation on mobile networks could be appropriate.

8.1.3 Necessity of access in case of phase two

Phase two of FMC, FMC with network integration, offers additional functionality compared to that of phase one, namely the ability to connect to a broadband connection whenever it is available at lower costs. Mobile operators are not able to deliver a comparable service with their mobile network only. Therefore without access to a fixed network and the necessary network facilities, mobile operators will not be able to compete with KPN because they face higher costs and can not offer higher quality.59

This does not necessarily mean that access to the integrated network of KPN will have to be enforced. Due to the rise of VoIP, mobile operators have the option of obtaining access to a broadband network based on DSL or cable instead of the integrated network of KPN in order to offer FMC. The question is, are these networks accessible? Due to regulation, potential entrants have access to the Unbundled Local Loop (ULL) of KPN. Any firm with a glass fibre backbone can claim access to the local loop of KPN on a wholesale level and thereby offer broadband services. Combined with VoIP, ULL presents mobile operators the opportunity of entering the market for FMC.

For a fixed operator, in phase two the only option to enter the market for FMC is to acquire access to the network of a mobile operator. Network integration is only possible when the fixed operator becomes an MVNO, because then the operator owns its own network components. An ESP will only be able to offer FMC with network integration if the functionality of the FMC-specific network facilities is added to the wholesale services provided by the MNO.

8.1.4 Conclusion

The argumentation above implies that, in both phase one and two, access to the integrated network of KPN is not required for third parties to enter the market for FMC. This corresponds to the consideration that a light regulatory approach is appropriate in case of an emerging market. Note however that as the market matures, a situation could arise on the retail level where KPN has SMP. In that case the possibility of entering the market for FMC without access to the integrated network facilities of KPN could be limited and an access obligation could become appropriate in order to encourage competition at the retail level.

59 In case mobile operators would face lower costs, they could be able to compete with FMC by offering a lower quality mobile-only proposition at a lower price. However, as a result of the lower prices of making fixed phone calls, an FMC provider can offer prices below those of mobile-only operators. Summarising, the mobile-only solution is has less functionality and is more expensive than FMC. Therefore mobile operators will not be able to compete with FMC in phase two with their mobile network only.
8.2 Remove entry barriers
To decrease concentration on the market for FMC, entry barriers have to be taken away. Two entry barriers to the market of FMC, brought up by market parties in the interviews, are the numbering plan and the current terminating tariffs used by mobile operators.

8.2.1 The numbering plan
Part of the business case of FMC is offering the customer one phone number, under which he or she can be reached independent of the infrastructure that the customer is connected to. In this thesis, this concept is called Personal Numbering\textsuperscript{60} (PN). Offering this service can be done with or without physical integration of the fixed and mobile networks. Without integration, PN can be achieved by putting the call through from fixed to mobile. This solution is not efficient, because the network is excessively used. This involves extra costs for the operator, which are eventually paid by either the initiator or the receiver of the phone call. This characteristic makes that putting through phone calls is not an attractive solution for PN. A solution that does not involve putting through phone calls but which is capable of making a phone number truly independent of the access technology, is network integration by means of an Intelligent Network (IN) technology. Summarised, PN is expected in phase 2 of FMC.

The problem is that, due to regulation, an operator is not allowed to use any phone number for any kind of service. This is prohibited by the numbering plan\textsuperscript{61} that, in the Netherlands, is established by DGTP, a department of the Ministry of Economic Affairs. The numbering plan is a set of rules that define what phone numbers can be used for what purposes. Compliance to the numbering plan is enforced by the regulator, OPTA. To enable the regulator to enforce compliance, the regulator has been given the responsibility of issuing phone numbers to operators.

8.2.1.1 The history of phone numbers
The use of phone numbers is originally technology driven. In ancient telephone switches each digit of a phone number had a direct relation to the actions of the relays in the switch and the port that the switch connected the line to. For years now, phone numbers have no technical function anymore. Switching is done by processors that link a phone number to a port, using number tables. The only function of a phone number is that of an identifier (ID). This ID could very well be a name, an IP number or any other way of identifying a person or location. However, being the legacy of ancient technology, the use of phone numbers is standardised. Interconnection requires the use of a standardised ID among all operators. A single operator can hardly make the choice of switching to another means of identification, since all the other operators still use phone numbers.

In the numbering plan a distinction is made between numbers with different purposes. This distinction is also the legacy of technology of the past. For example if a number would start with 070, the switches could, based on these first digits, route the call towards The Hague. Today, giving services numbers with particular first digits is no longer necessary for routing. Still this way of numbering often has advantages that do not relate to routing but to informing the caller

\textsuperscript{60} In the UK, there is a range of numbers assigned specifically to Personal Numbering. The term Personal Numbering as used in this thesis is not related to this range of numbers. In this research, Personal Numbering means being accessible with a single phone number. Which kind of numbers are to be used for this feature is subject to discussion.

\textsuperscript{61} Several numbering plans can be found on the website of the Ministry of Economic Affairs: www.ez.nl. The numbering plan referred to in this thesis is the so called “Nummerplan voor telefoon- en ISDN-diensten”. Directive General Telecom and Postal services.
of some characteristics of the phone call. In the case of calling a 070 number, the caller is
informed through the number that the call is being made to The Hague.

The distinction that is particularly interesting for this report is the distinction between fixed
geographical numbers and mobile numbers. Due to the numbering tables in the switches, the
distinction between fixed and mobile numbers is not necessary for switching purposes. The
distinction however has another purpose: to provide the consumer with an indication of the tariff
of a phone call in advance of initiating the call.

8.2.1.2 Price indication of a phone call

The phone number gives an indication of the price. At present, a phone call from a fixed line to
a mobile number is usually more expensive than a phone call to a fixed geographical number.
FMC raises the following question: How does a caller know the price of a phone call? After all
the caller does not know the means by which the receiving party is connected. If the distinction
between fixed and mobile numbers were to disappear, so will the price indication.

Possible solutions to this problem were suggested by several respondents in the GDR session:
- An indication of the price could be given “on screen”,
- An indication of the price could be given by automated speech,
- The Calling Party Pays (CPP) principle could be abandoned.

The last suggestion implicates a construction much like the one used for international mobile
roaming. The initiator of a phone call would then pay a standard price corresponding with the
price for a fixed geographical phone call. The receiving party pays the price difference in case
he or she is connected to a mobile network. This principle is called Receiving Party Pays (RPP)
(Singh 2002), but this term can be somewhat confusing since it implicates that the total costs of
the phone call are covered by the receiving party. Actually, this is a shared cost system.

Not only in international roaming the receiving party pays principle is applied. Also the *21
service (call forwarding) works on this basis. Furthermore, in the United States the receiving
party pays principle is used for all mobile telephony. The difficulty does not lie in the principle
itself, but in the transition towards such a system. Not only would the total cost allocation
system of the telecom operators have to be adjusted, also the public awareness will have to
change and it is likely that both operators and customers will be hesitant.

The first two options have the disadvantage of being costly for the operators. Operators argue
that if there would be customers’ demand for an on-screen or spoken price indication,
competition will ensure that this feature is included in an FMC offer. However an obligation
imposed by the regulator to give such an indication and, consequently, to pay for the
implementation, is perceived to be an obstruction for innovation by the market parties
interviewed.

It can be argued that the initial goal of offering a price indication is no longer valid. Some market
parties that are interviewed indeed argue that the difference between tariffs for fixed and mobile
telephony is diminishing. The tariffs for making a call to either a fixed geographical phone or a

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63 Usually, since there is no direct relation between the numbering plan and the tariff that is applied to a phone call.
Therefore it is possible that, under particular circumstances, a phone call from a fixed line to a geographical number is
as expensive or even more expensive as a phone call to a mobile number. Generally however, this is not the case.
64 This objection was emphasised by several parties in the GDR session.
mobile phone are becoming more and more comparable. Therefore the need to distinguish between these services could diminish in time. We analyse the current tariffs for termination on the different networks to check whether this reasoning holds. Table 8.1 and Figure 8.1 show the MTA and the FTA tariffs at the end of the year 2004. Numbers show that today there still is a significant difference between the prices for a phone call to either a fixed or a mobile phone.

<table>
<thead>
<tr>
<th>December 1\textsuperscript{st} 2004</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>KPN Mobile, Vodafone</td>
<td>€ 0,130</td>
</tr>
<tr>
<td>Orange, Telfort, T-Mobile, Tele2</td>
<td>€ 0,147</td>
</tr>
</tbody>
</table>

\textit{Table 8.1: MTA tariffs of the Dutch MNOs}\textsuperscript{65}

In OPTA’s provisional market analysis of the wholesale mobile market, the goal is set to lower the MTA tariffs to an acceptable level by 2008. The tariff levels should then be cost based\textsuperscript{67}. Exactly how much the tariffs will decrease as a result is not known yet. Will this instigate the diminishing of the difference between fixed and mobile prices for a phone call? If this is the case, it could be that the need for different phone numbers will also diminish in time. However, the gap between the MTA and the FTA tariffs is so big that, at least on the short run, it is not expected that they will balance. This vision is supported by the expectation that VoIP will establish fixed voice services at considerably lower prices than traditional fixed telephony, thus widening the gap.

\textsuperscript{65} OPTA, Mededeling inzake beleid OPTA ten aanzien van mobiele terminating tarieven, December 2003.

\textsuperscript{66} OPTA’s draft decision on the market for wholesale fixed telephony, July 2005.

\textsuperscript{67} The method used will be Long Run Incremental Cost (LRIC). This method is described and recommended in \textit{Principles of implementation and Best Practices on the application of remedies in the mobile voice call termination market} of the European Regulators Group.
8.2.1.3 Location information for the emergency service 112

There could be another problem that arises when the distinction between fixed and mobile numbers disappears. Ever since the liberalisation of the telecom market, consumer protection obligations have been applied to public telecom services that used geographical numbers. As a result of that, consumers associate fixed lines and corresponding geographical numbers with, for example, the possibility of calling an emergency service. Therefore, it is undesirable to use geographical numbers for services on which operators are not obligated to offer lifeline service.

In section 8.4.2 the conclusion is drawn that life line services are available on both the cellular networks and the fixed networks that offer voice services. The consumer protection associated with geographical numbers does not seem to be a problem, because the same consumer protection legislation is applied to the mobile network as well.

However, there is a complication. When a user with a geographical number dials the emergency number 112, the call is routed towards the nearest emergency centre. At this centre, using the geographical number, the location of the caller can be automatically determined. This enables the centre to send whatever help that is needed as quickly as possible to the address corresponding to the phone number.

When a mobile user dials 112, based on the mobile number its call is routed to a central emergency centre. At this centre, the operators are instructed to ask for the location of the caller, since the address can not be derived from the phone number. The difference in call handling at the emergency service could be a problem when PN is introduced. More about this subject can be found in section 8.4.2.

8.2.1.4 Number portability

The regulatory enforcement of number portability has been applied because the inability of keeping one’s phone number was considered to be an entry barrier for potential competitors in the fixed telephony market (Srinagesh and Mitchell 1999). Therefore in Europe, number portability is an obligation that all fixed telephony operators have to comply to. In the mobile market, customer churn is and has always been high: an average of 25 percent in Europe. Many European regulators argue that this suggests that for the mobile market the lack of number portability is not a major barrier for entry. Others disagree. In the Netherlands, among other countries like the UK, Sweden, Italy and Spain, the obligation to offer number portability is also imposed on the mobile market.

Considering FMC, number portability is of utmost importance. When fixed geographical numbers and mobile numbers are not available for FMC, consequently another range of numbers will have to be used. In that case, the customers will not be able to keep their current phone number when switching to an FMC service. The result is that customers could feel constrained to remain with a single operator instead of migrating to whichever operator that can best serve their particular needs. This is considered to be an entry barrier for the market of FMC.

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68 In the Netherlands, this centre is located at Driebergen.
8.2.1.5 The current numbering plan

In the numbering plan, each defined category of numbers is assigned to a certain purpose. Derived from the numbering plan, there are four categories of phone numbers that qualify for PN:

- Geographical numbers (070/015/etc.)
- Mobile numbers (06)
- Numbers for personal assistant services (084/087)
- Business numbers (088)

In the following sections each category will be analysed on their applicability for FMC services. Also, the price indication issue, the emergency service issue and number portability will be discussed per category.

Geographical numbers

A geographical number gives an indication of the location of the user. This property is convenient because with the location, the caller also knows whether the phone call is long distance or not. Because local and long distance phone calls differ in price, geographical numbers give an indication of the price of the phone call.

VoIP raises the issue whether geographical numbers can be maintained. Because of its nomadic characteristics (section 3.4.1.2), issuing a phone number to a certain geographical area seems problematic. How can an operator keep its customer within that area? And even when this is possible, is this desirable? The nomadic characteristic of VoIP is in fact one of its major benefits.

Market forces have to a large extent diminished the difference between tariffs for local and long distance phone calls and the expectation is that within a few years the difference will be gone. This implicates that also the need for geographical numbers could disappear.

As explained in section 8.2.1.2 phone calls from a fixed line to a mobile subscriber still have a substantial higher price than those to a fixed subscriber. As long as the tariffs for making phone calls to either a fixed or a mobile phone differ substantially, using geographical numbers for FMC is not desirable.

When a geographical number is used for a subscriber that is in fact mobile, problems will occur at the emergency service. The switches will recognise the geographical number and determine the corresponding address. Since it is presumed that the address is known, the operator will not ask the caller for a confirmation and send help as quickly as possible. The FMC subscriber could very well be in desperate need for help somewhere else.

When using geographical numbers for FMC, number portability is possible between fixed services and FMC services. Fixed subscribers will experience no impediment for switching towards FMC, at least not concerning number portability. However users with a mobile phone number will experience the lack of number portability as a barrier to entry to the market of FMC.

Mobile numbers

The use of mobile numbers could be a solution to overcome the problems with using geographical numbers as mentioned in the previous section. The price associated with mobile numbers is generally higher than the price associated with a geographical number. Therefore the consumer will associate calling an FMC user (someone that can be reached either by fixed
line or by mobile phone) with a relatively high price. The real price will be either the associated price or lower, so the consumer’s interest is protected.

From the operator’s point of view, this situation is not beneficial. An operator will strive for a situation in which a caller has a low price association, but where in fact the price is high. In that case the consumer will not be scared away and make the phone call, which is the goal of the operator. Using mobile numbers with the corresponding high price indication will not be favored by the industry.

In the numbering plan, mobile phone numbers are meant for mobile telephony. The definition of mobile telephony as used by OPTA is: “telephony in which a radio network is used and where communication by the user is possible while moving over large distances”\(^70\). OPTA admits\(^71\) that this description is rather ambiguous and therefore states that each request for a mobile number will be assessed individually. WiFi and WiMax however, though radio network technologies, are not considered as a medium for mobile telephony as meant by the definition above\(^72\). This point of view corresponds to the demarcation of fixed and mobile telephony as used in this report and described in section 3.1.

In the "Beleidsregels VoIP nummering", OPTA confirms that mobile numbers can only be used for a VoIP service when this service uses a radio network. By radio network, a cellular radio network like GSM or UMTS is meant. For FMC services the regulation of OPTA is similar.

When a FMC subscriber uses a mobile number and dials 112, the call will be redirected to the central emergency centre, where the location of the caller will be asked. The redirection of the call will happen even if the caller is at home and dialing from its fixed wire line. In the ideal case, the call would be routed to the nearest emergency centre so that help can be sent as quickly as possible. Hence, as a result of using a mobile number for PN, the service level delivered by the emergency centre decreases.

Using mobile numbers for FMC, number portability will be possible between mobile services and FMC services. Mobile subscribers will experience no impediment for switching towards FMC, at least not concerning number portability. However, users with a fixed geographical number will experience the lack of number portability as a barrier to entry to the market of FMC.

When mobile numbers are to be used for FMC, either the definition of mobile telephony has to be adjusted or the entire purpose of mobile numbers will have to be changed in the numbering plan. Also, it will have to be accepted that a phone call from the subscribers home is treated as a mobile phone call by the emergency centre, accompanied by the corresponding service level in case of an emergency.

In case of a business case in which a universal tariff is used independent of the means by which the user is connected, the use of a mobile number could present the problem that the operator charges a price corresponding to a mobile phone call while, at least some of the time, the user is connected to a fixed line. The consumer would then be paying an exorbitant rate.

**Numbers for personal assistant services**

\(^70\) OPTA, Beleidsregels VoIP nummering, April 2005.
\(^71\) OPTA, Bijlage Beleidsregels VoIP nummering, April 2005.
\(^72\) OPTA, Beleidsregels VoIP nummering, April 2005.
A special category in the numbering plan are the numbers for personal assistant services (084/087). These numbers can be seen as the consumer’s equivalent of business numbers. Personal assistant service numbers can be used for both fixed and mobile telephony. Use of these numbers for FMC services seems appropriate. DGTP confirms that the personal assistant numbers are suitable for FMC services73.

More than mobile numbers, numbers for personal assistant services have a negative image because of their often high tariffs. In the GDR it was suggested that this image problem will disappear naturally as the number will increasingly be used for services with a lower tariff. Despite the optimistic view of some operators, the interviews show that most operators are hesitant to use the numbers for personal assistant services.

Number portability is an issue when numbers for personal assistant services are used for FMC. Both fixed and mobile subscribers will not be able to keep their current phone number when switching to an FMC service. This is an entry barrier to the market for FMC.

Today, numbers for personal assistant services are available for VoIP. Geographical numbers are also available, but only when the operator commits itself to try to keep the subscriber within the corresponding geographical area and not promote the use of the nomadic functionality of VoIP. The new numbering plan that is scheduled for 2005 will allow the use of geographical numbers for IP telephony and voice over broadband (in section 3.4.1.2 the different categories of VoIP are explained). The use of the numbers for personal assistant services can be useful as a solution for the truly nomadic variants of VoIP, such as categories 2, 3 and 4 mentioned in section 3.4.1.2.

For FMC, numbers for personal assistant services are the only numbers available today. The impact of FMC on the numbering plan is not yet part of the agenda of DGTP. One can imagine that in the future, as the tariffs for fixed and mobile telephony become more comparable, the use of different phone numbers for different services will be abandoned. Until that time, personal assistant service numbers provide an alternative.

Business numbers

Business numbers are the business’ equivalent of the numbers for personal assistant services. These numbers are not related to a geographic location nor restricted to either fixed or mobile services. They do not have a bad reputation like numbers for personal assistant services do. Therefore companies can use these numbers for FMC services. Business numbers are not available for consumers.

8.2.1.6 DGTP initiative for a new numbering plan

On September 1st 2005, DGTP has proposed a modification74 of the numbering plan to a Dutch national consultation forum called the Nationaal Nummer Overleg (NNO). In this proposal two new number ranges are introduced to cope with the price indication problem as discussed in section 8.2.1.2. Also, the purpose for fixed geographical numbers is redefined to make these numbers available for nomadic services like VoIP. In the current numbering plan, the access point to the fixed network has to be located in the geographical area that corresponds to the

73 DGTP, Besluit houdende wijziging Nummerplan telefoon- en ISDN-diensten, Staatscourant, October 2001
prefix of the phone number. In the proposal, the access point can be anywhere, but the residence of the subscriber has to be in the corresponding geographical area.

Both proposed new number ranges can be used independent of the geographical location of the user. In other words: for both fixed and mobile telephony. There is a difference though. The first number range, starting with digits 085, has a maximum wholesale terminating tariff. This means that the good image of the number, i.e. the perception of the relatively low price of the phone call, is secured. The second range, starting with digits 091, can be used when the terminating tariffs are too high to use a 085 number. Consequently, this number range will lack the good image.

The emergency number issue and the number portability issue still stand. However, the strategy seems adequate in dealing with the price indication issue.

There is a downside. The complexity of the numbering plan increases with the introduction of the extra number ranges. The consumer is supposed to keep up with the developments and know which number represents which price or service, but in reality, the question is whether the consumer will be able to do just that.

The proposal has not been implemented yet and is still pending on a consultation procedure. This means that it is still possible to convince the involved parties of a different solution.

8.2.1.7 Conclusion

The current numbering plan does not allow the use of geographical or mobile numbers for FMC. However, there is the possibility of using numbers for personal assistant services or business numbers. The numbers for personal assistant services have a negative image because of a history of high tariffs. Also, consumers will not have the possibility of number portability. Despite these downsides, these categories of numbers are the only numbers applicable for FMC, at least within the current numbering plan.

Still, the mobility that WiFi and WiMAX add to traditionally fixed telephony will have to be recognised at some point. Maintaining geographical numbers for a service that to some extent has become mobile seems irrational. Therefore the use of geographical numbers will not hold on the long run.

Our analysis shows that the current numbering plan is an impediment for entry to the market for FMC. Either a new number range will have to be introduced or the current distinction between fixed geographical numbers and mobile numbers should be abandoned. The proposal of DGTP to introduce the two new numbering ranges 085 and 091 sufficiently deals with the price indication issue, but fails in solving the number portability issue and creates an impediment for market entrance. Therefore an effort will have to be made to come up with a better solution.

In the years to come, the difference between the price of a phone call to a fixed phone or a mobile phone should be monitored. As soon as the difference has diminished, assuming that it will, the need for different numbers will be gone and a universal number for both fixed and mobile phones can be introduced. This is desirable because of the poor reputation of the numbers for personal assistant services, and because it will solve the number portability issue, truly enabling the operators to offer personal numbering.
What can OPTA do? OPTA supervises compliance with the numbering plan and issues the phone numbers to market parties, but modification of the numbering plan can only be done by DGTP. What OPTA can do, is lobby and try to send DGTP in the right direction.

8.2.2 Terminating tariffs

Operators are obligated to interconnect with other operators on the market in order to allow their customers to be able to reach anyone they would like (section 6.1.2, Interconnection). This means that when a phone call is being made to another operator, the originating operator has no choice but to request access to the other operators’ network on which the call is terminated. The relationship between call origination and call termination is shown in Figure 8.2.

![Call Origination, Call Transfer, Call Termination Diagram](image)

Figure 8.2: Call origination, call transfer and call termination

In calling party pays systems, terminating tariffs represent the amount a network that originates a call pays to the network that terminates a call (Gans 2000). The higher the terminating tariff, the higher marginal call costs and consequently, the higher the price of the phone call.

When a phone call to a mobile phone is made, the mobile network operator charges the operator of the caller for the use of its mobile network. The price that the operator of the caller pays to the mobile operator is called the Mobile Terminating Access (MTA) tariff. The other way around, when a phone call is being made to a fixed phone Fixed Terminating Access (FTA) tariffs are charged by the fixed operator.

A number of papers by Laffont, Rey and Tirole (1998), Armstrong (1998) and Carter and Wright (1999) raise the concern of monopolistic pricing strategies for call termination despite the presence of competition between the networks at a retail level. The reason that operators can charge terminating tariffs above marginal costs is that the customer’s choice for an operator does not involve an evaluation of the terminating tariffs applied by the operator. In fact, the terminating tariff does not affect the subscriber itself, but only the callers to that subscriber.

8.2.2.1 The gap between mobile terminating tariffs and fixed terminating tariffs

When only the MNOs are considered, the amount of traffic from the network from one operator to the network of another operator will be balanced with the amount of traffic in the opposite direction. For example, Orange customers will make about the same amount of phone calls to KPN Mobile customers as the amount of phone calls KPN Mobile customers make to Orange customers. This assumption is the result of logic reasoning.

Suppose that operator A has 90 subscribers and operator B has 10 subscribers. Two assumptions are made:

- A subscriber makes an average number of phone calls per day, say 10;

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75 OPTA’s draft decision on the market for wholesale fixed telephony, July 2005.
Subscribers make phone calls irrespective of the provider that the receiving party is subscribed to.

This means that each day a subscriber of operator A makes an average of nine phone calls to subscribers of operator A and one phone call to a subscriber of operator B. A subscriber of operator B makes an average of nine phone calls to subscribers of operator A and one phone call to a subscriber of operator B. In total, 90 times one phone call is made from operator A to operator B and 10 times nine phone calls are made from operator B to operator A. The conclusion is that the traffic in both directions is balanced. In Figure 8.3 we have constructed a simple formula that explains why this works for any number of subscribers of operator A and operator B.

\[
\begin{align*}
\text{If} \\
a &= \text{number of subscribers to MNO A} \\
b &= \text{number of subscribers to MNO B} \\
c &= \text{average number of outgoing phone calls per subscriber per day}
\end{align*}
\]

Then the number of phone calls from A to B

\[
\begin{align*}
n_{A \rightarrow B} &= a \cdot c \cdot \frac{b}{a+b} \\
&= \frac{a \cdot b \cdot c}{a+b}
\end{align*}
\]

And the number of phone calls from B to A

\[
\begin{align*}
n_{B \rightarrow A} &= b \cdot c \cdot \frac{a}{a+b} \\
&= \frac{a \cdot b \cdot c}{a+b}
\end{align*}
\]

Hence

\[
\begin{align*}
n_{A \rightarrow B} &= n_{B \rightarrow A}
\end{align*}
\]

Figure 8.3: Why traffic between MNOs is balanced

Therefore, if only MNOs are considered, the price of MTA is not that important, because the MNOs pay as much for MTA as they receive. For this reason, in France the MNOs have made an arrangement not to charge one another for terminating but instead only to keep record of the costs made. This arrangement is called “bill and keep”.

The situation changes when fixed operators are considered also. FTA tariffs are relatively low. The reason for this is the fact that the FTA tariff of both KPN and the other fixed operators is regulated to a cost-based level. When a subscriber of a fixed operator makes a phone call to a mobile user, the fixed operator is being charged the relatively high MTA tariff by the MNO. The other way around, when a mobile subscriber makes a phone call to a fixed line subscriber, the low FTA tariff is charged. This situation is not beneficial for the fixed subscribers. In a way, they pay for a reduction of prices for mobile users.

MNOs claim that the situation is not disadvantageous for fixed subscribers, since today every fixed subscriber also has a mobile phone. Following their reasoning, the MTA tariffs paid by the
fixed user lower the costs of its own mobile phone, thereby playing even. This argument is rejected by OPTA since there are many fixed line subscribers not owning a mobile phone and even if this would be the case, there is no logical explanation why these cash flows would be balanced.

The difference between the fixed and mobile terminating tariffs is perceived as a barrier for FMC. This difference is the cause of the earlier mentioned issue of a price indication of a phone call. Also, setting a flat fee or flat rate for a bundle of fixed and mobile telephony is being hampered by the difference in terminating fees, due to the risk of price squeeze and the difficulty of defining user profiles. Even when user profiles can be defined, there’s the concern that adverse selection might occur. Adverse selection means that a user adjusts its behaviour when he is confronted with a terminating fee that is based on the user’s average behaviour. For example, when an operator would choose a terminating tariff higher than the FTA tariff, but lower than the MTA tariff, the user could choose to postpone making the phone call until the receiving party is mobile, because in that case the caller experiences a discount compared to the MTA tariffs that he would normally pay.

Levelling the tariffs for fixed and mobile terminating unfortunately will not be easy and, understandably, will not have the support of the mobile operators.

In 2002, the NMa initiated a research assessing the height of the mobile terminating tariffs. The mobile operators responded by proposing a deal to the NMa: the MTA tariffs would be lowered if the NMa in return would call off the investigation. Considering the amount of time that it would take to conclude the investigation and, assuming the conclusion that market power was abused, to finish procedures and to impose fines, the NMa realised that accepting the deal would have the most beneficiary result for the consumer. OPTA agreed but emphasised that the MTA tariffs would be re-evaluated when the NRF would be in place. The deal was accepted. The MTA tariffs that were agreed upon are listed in Table 8.2.

<table>
<thead>
<tr>
<th></th>
<th>1st step January 1st 2004</th>
<th>2nd step December 1st 2004</th>
<th>3rd step December 1st 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>KPN Mobile, Vodafone</td>
<td>€ 0,155</td>
<td>€ 0,130</td>
<td>€ 0,110</td>
</tr>
<tr>
<td>Orange, Telfort, T-Mobile, Tele2</td>
<td>€ 0,175</td>
<td>€ 0,147</td>
<td>€ 0,124</td>
</tr>
</tbody>
</table>

*Table 8.2: MTA tariffs of the Dutch MNOs, as agreed upon in December 2003*

In the draft decisions of 2005, OPTA has decided that MNOs have SMP on the market for call termination on their own network. Consequently, MTA tariffs will be adjusted downwards to a cost-based level by enforcing regulation. To completely overcome the barriers for FMC ideally the MTA and the FTA tariffs would have to be leveled. The question is whether this can be achieved by bringing the MTA tariffs back to a cost-based level. MNOs are reluctant in giving insight in the costs of maintaining a mobile network, but claim that the costs are considerably higher than is the case for fixed networks. Although exact figures are not known, it can be assumed that however the MTA tariffs will decrease when establishing a cost-based tariff level, it is unlikely that they will be balanced with the FTA tariffs.

76 OPTA’s draft decision on the market for wholesale mobile telephony, March 2005.
77 OPTA, Mededeling inzake beleid OPTA ten aanzien van mobiele terminating tarieven, December 2003.
Though the tariffs will become increasingly comparable, they will always differ. The solution therefore should not be sought in adjusting these tariffs to become equal, but in solving the problems that arise as a result of this difference.

An issue closely related to mobile terminating tariffs is the subsidisation of handsets. This issue is discussed in the next section.

8.2.2.2 Handset subsidisation
A way of attracting customers is subsidisation of handsets. Mobile operators use revenues from either call termination or increased retail tariff plans to be able to offer cheap or even free mobile phones to the customer. Instead of a discount on the handset it is also possible to offer cash-back. In this case the customer does not purchase a handset but only a subscription, and receives an amount of money in return. When the subsidies are paid for by increased retail tariff plans, the end-user often makes a commitment to a subscription of a fixed period of time, for example one or two years.

In the interviews, several fixed operators claimed that the mobile operators subsidise their handsets with revenues from call termination. The mobile operators neither confirmed nor denied this statement. From call termination charged to fixed operators\(^78\), MNOs in the Netherlands make a profit of about 150 to 300 million euro\(^79\) per year. This profit can be used to subsidise handsets, but also to decrease retail tariffs, to recover the costs of radio frequencies and to cover other expenditures. It is also possible that handset subsidies are not entirely paid for from call termination, but also from retail tariffs. Still, the fact remains that the income of the MNOs from call termination is a means to subsidise handsets that the fixed operators do not have.

Transferring revenues from call termination to a discount on handsets is a form of cross subsidisation. In the past, this was allowed because the MNOs did not have SMP on the market of mobile terminating. In the market analysis of wholesale mobile telephony in 2005, OPTA decided that MNOs in fact have SMP on the market for call termination. This allows OPTA to impose obligations to bring the terminating tariffs to a cost-based level. The cross subsidisation in itself is not perceived as the primary problem by the regulator. It is perceived to be a phenomenon that is caused by another problem: the tariffs for MTA are excessively high, considering that each MNO is a monopolist on the market of terminating on its own network.

A customer of mobile telephony makes its choice for a mobile operator based on the price of the handset and the retail prices of a phone call to either a fixed or another mobile phone. It is shown\(^80\) that the costs of a phone call from somebody else to the particular consumer is not part of the consumer’s decision criteria. Therefore, it is only natural for an MNO to lower its handset prices at the expense of the mobile terminating tariffs. It is assumed that it is possible for an operator to change its cash flow to a situation without handset subsidy. Its handsets would naturally be more expensive, but the terminating tariffs could be lowered. However it is highly unlikely that a single operator stops subsidising its handsets, since other operators will still be

\(^{78}\) Call termination charged to mobile operators can not be considered profit, since approximately the same amount of money has to be paid for access to other mobile operators’ networks.

\(^{79}\) OPTA’s draft decision on the market for wholesale mobile telephony, March 2005.

\(^{80}\) NMa, Rapportage over de marktdefinitie van het afwikkelen van gesprekken op mobiele netten, August 2002.
offering low-priced mobile phones. Therefore the situation of cross-subsidisation is unlikely to change without interference (Daoud 2004).

Handset subsidies are a problem for operators that only have a fixed network and try to enter the mobile market. They are forced to subsidise their handsets to be able to offer an interesting deal to the consumer. However, they do not have any income from mobile call termination, so they do not have the means to pay for the subsidy like mobile network operators have.

8.2.2.3 Conclusion
In the current situation, mobile operators offer handsets to the customer with a considerable discount or even for free. The handsets are subsidised with either revenue from retail prices or revenues from wholesale terminating. In order to make an interesting deal to the customer, a party entering the mobile market is forced to subsidise its handsets also. The height of the investment that accompanies this subsidisation can be seen as an impediment for entering the mobile market for potential competitors. But does this entry barrier justify intervention by OPTA?

In fact, this issue is already being addressed by OPTA. In the market analysis of terminating on mobile networks, it is determined that mobile operators have SMP on the market for wholesale mobile terminating on their own network, and are therefore subject to regulation. The implication is that the MTA tariffs will be regulated to a cost oriented level, thus reducing the possibility of making an exorbitant profit on terminating. Thereby the mobile operators’ advantage of having extra income from terminating has disappeared. Fixed operators will have the same opportunities as the mobile operators as far as handset subsidisation is concerned. The course of action taken by OPTA is adequate in dealing with the issue of handset subsidisation. As fixed operators will have the same possibilities of making their business case for FMC as mobile operators, our judgement is that no extra intervention is needed.

8.3 Prevent anti-competitive behaviour
In the interviews several market parties shared their concern that FMC could encourage KPN to leverage its market power from the fixed market to the mobile market or from the fixed market to the market for FMC81. The incumbent could apply anti-competitive behaviour to leverage its market power from one market to the other. There are two types of anti-competitive behaviour that can occur in the case of FMC: too low pricing and illegal bundling.

8.3.1 Too low pricing
Low prices are essentially beneficial to the customer. However, there are situations in which low prices can harm competition. The issue of too low pricing can be subdivided into two categories: predatory pricing and margin squeeze.

8.3.1.1 Predatory pricing
Predatory pricing occurs when a market party offers its product below cost price for a certain period in time, with the intention of driving competitors out of the market. When competitors are successfully driven out of the market, the company raises its prices to an excessive level in order to recoup the losses made due to the initially low prices. This strategy is called predatory pricing.

81 Depending on the phase of FMC and the corresponding market definitions, as discussed in chapter 7.
Predatory pricing is only beneficial if the market is imperfect, for example if there are barriers to entry. These barriers will ensure that once a dominant position on the market is established, there will not be new entrants once the prices are excessively raised.

It should be noted that offering a product below cost price in itself is not always aimed at driving competitors out of the market. It can also be a strategy to promote a new product that is being introduced or to generate a financial impulse to be able to finance large initial investments in a new product. Only when the primary objective of offering a product below cost price is to drive competitors out of the market, this is called predatory pricing. Predatory pricing is always a problem for competition and is prohibited by Competition Law. Therefore preventing predatory pricing belongs to the jurisdiction of the competition authority NMa.

In order to overcome the period of low pricing a company can use revenues from other products or services to financially support the strategy. This is called cross-subsidisation. If the prices of a product on a non-regulated market are subsidised with revenues from a horizontally related market on which the company has SMP, the company could leverage its market power from the SMP market to the other market. Horizontal leverage of market power means that a company uses its dominant position on a market to increase its position on another, potentially competitive market. Whereas in the SMP market, a price above costs is charged, in the other market, the market where the SMP-position is leveraged to, a price below costs is charged.

Leverage of market power in itself is not necessarily a problem. Leverage of market power is only a concern in horizontally related markets on which a firm is involved that has SMP and when that firm is capable of offering services on the potentially competitive market. Fixed and mobile telephony are horizontally related markets. KPN has SMP on the market for fixed telephony and has a mobile division. Therefore the issue of horizontal leveraging is at hand and the risk of predatory pricing should be assessed.

KPN would be applying cross-subsidisation if the benefits made from the fixed connections would be used to offer a discount on a mobile connection. Mobile telephony would then be offered below cost price, while the losses are covered by profits from fixed telephony. This is an example of cross-subsidisation of below cost pricing in one market by setting regulated price in a second market above socially efficient level (Viscusi 1995). However mentioned in the interviews, cross subsidisation seems not directly related to FMC. Offering voice services independent of the access technology does not increase or decrease the possibility of cross-subsidisation. The risk of horizontal leverage of market power therefore mainly originates from bundling.

8.3.1.2 Margin squeeze

While predatory pricing is the domain of the Competition Authority, margin squeeze is prevented by the NRA, OPTA.

Margin squeeze can occur when part of the service is offered on a wholesale basis to other companies. Margin squeeze means that the prices set by the market party with SMP for their

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82 ERG, Common position on the approach to appropriate remedies in the new regulatory framework, ERG(03)30rev1, April 2004.
84 All participants of the GDR session agreed that the issue of cross-subsidization is not particularly related to FMC and should be left aside in the discussion.
retail services are too low compared to the wholesale prices charged to other third parties. In that case the competitors will not be able to make a profit.

To prevent the incumbent from applying margin squeeze, OPTA applies a price squeeze test. An operator complies to the price squeeze test if the retail price is equal or lower than the sum of the cost price of the service, retail costs, an efficiency deduction and an allowed profit margin. OPTA considers the cost price of the service to be equal to the wholesale prices that are charged to third parties, since these prices are regulated and therefore cost-based. The retail costs are added because these are not included in the cost-based wholesale prices. The efficiency deduction is based on the assumption that the incumbent is not optimally efficient and should be stimulated to be more efficient. Based on the price squeeze test a bottom price is set for the incumbent’s retail prices.

8.3.2 Illegal bundling

A company seeking sustainable competitive advantage can apply bundling when the combination of two or more resources is hard to imitate. In case of the presence of a company that has SMP on the market of one of the components of the bundle, bundling could have anti-competitive effects.

In the new regulatory framework, the incumbent has gained the privileges of bundling fixed telephony with another product and offering telephony on a flat fee basis. Together these privileges form the opportunity of introducing FMC services, starting with a bundle of fixed and mobile telephony. Note the difference between flat fee and flat rate. Flat fee means that the customer pays a fixed amount of money per month independent of the amount of phone calls made or the duration of the phone calls. Flat rate means that wherever the phone call is made to, the price per minute is the same.

Traditionally, telecom operators are able to offer block of time tariffs. A block of time tariff means that for a single periodic up-front fee, calls can be made for a certain amount of minutes during a certain period, e.g. during off-peak hours and during weekends. Blocks of time have a maximum amount of calling minutes. This makes it easy to perform a price squeeze test, because the price per minute was at its lowest if the customer would use the entire amount of minutes while using the most expensive element of the bundle. The price per minute can therefore easily be retrieved.

The possibility of offering fixed telephony on a flat fee basis requires a new approach. Because there is no maximum amount of minutes that the user can call with such a proposition, the use of user profiles is necessary. A user profile determines the average number of minutes that a customer spends on phone calls when he or she is offered to call at flat fee and the characteristics of these phone calls (call-setup costs, local or long distance, low-rate or peek-rate, to a fixed geographical service or to a mobile service, etc). This way it is still possible to retrieve the price per minute and to perform the price squeeze test.

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85 In the Netherlands these are called “belbundels”.
86 OPTA, Strategic behaviour and foreclosure on telecommunications markets, RPN01, March 2004.
87 OPTA, Strategic behaviour and foreclosure on telecommunications markets, RPN01, March 2004.
When analysing the impact of the introduction of a bundle of fixed and mobile telephony on regulation, first it has to become clear what exactly the bundle looks like. Generally, there are two ways of offering such a bundle:

1. The customer purchases a single subscription to both fixed and mobile telephony, but the tariffs remain to be accounted separately. The user pays different prices per minute for fixed and mobile phone calls.
2. The customer purchases a single subscription to both fixed and mobile telephony and phone calls, whether fixed or mobile, are made on a flat rate basis.

There are two kinds of bundling: pure bundling and mixed bundling\(^8^8\). In a pure bundle the products are only sold together, so the products can not be purchased separately. In a mixed bundle, the products can also be bought separately. In both situations 1 and 2, a fixed line subscription or a mobile subscription will still be available separately. Therefore a bundle of fixed and mobile telephony is a mixed bundle.

Pure bundling by a market party with SMP is prohibited by Competition Law. Because fixed telephony and mobile telephony will still be available separately (section 5.3), an FMC bundle will be a mixed bundle. Because FMC is a mixed bundle, there is no problem from the point of view of the competition authority NMi considering this issue\(^8^9\). However, there could be anti-competitive effects of mixed bundling that ask for the attention of the ex ante regulator. Because fixed and mobile telephony are considered to be separate markets, FMC is a case of horizontal bundling. A risk of horizontal bundling over two product markets is leverage of market power from one market to the other\(^9^0\). This is a concern that was also mentioned by several market parties in the interviews.

Generally, the price of a mixed bundle will be lower than the sum of the prices of the separate products. This way customers are persuaded to:

- buy the bundle instead of the two separate products, or
- buy the bundle instead of one of the products, or
- buy the bundle instead of buying nothing.

Companies can offer bundles at lower prices when there are benefits from increased efficiency of bundling as a result of economies of scope. Also generally, customer churn reduces once they start buying the bundle instead of the separate components.

By contrast, it is possible that the price of the bundle is the sum of the prices of the separate products or even higher. This is possible when the value of the bundle is higher than the value of its components. Consequently, when the bundle is offered at the same price as the sum of the prices of the components, but the bundle has an increased value, economically speaking there is still a discount being offered.

In the case of bundling fixed and mobile telephony, there are benefits from increased efficiency due to organisational integration. This bundle however has some benefits to the customer like receiving a single bill, the ease of choosing one operator instead of selecting an operator per

\(^8^8\) A third kind of bundling is tying. This means that purchasing product A is only possible in combination with product B, but not the other way around: product B can be purchased without product A. This special case of bundling is not present in FMC.

\(^8^9\) Predatory pricing however could still be an issue.

service, etcetera. Therefore the value of the bundle is higher than the value of the separate services.

In case of FMC with a degree of network integration (phase two as described in section 3.3), the benefits for the customer are even more clear: using one device with a single address book independent of the access technology and using a single phone number being the two most important benefits. This increases the value of the bundle even more. Because of the additional value of the bundle compared to buying fixed and mobile telephony separately, the price of the integrated product is not necessarily lower than the sum of the separate products. If the price of the bundle is indeed higher than the price of its components, no problems are expected. If the price of the bundle is lower than the price of its components, the risk of predatory pricing is at hand.

In an oligopoly, bundling can lead to an increase of competition and lower profits for the involved companies. This is a direct result of the fact that the price of a bundle is generally lower than the price of the two separate products. However, bundling can also be a means to decrease competition on a particular market by leverage of market power (Hylkema et al. 2005). Consider two markets: a market on which a market party has a dominant position and a market that is potentially competitive. Decreasing competition expresses itself in a reduction of rivals’ demand in the potentially competitive market or an increase in the costs of entry in the potentially competitive market and thus may lead to foreclosure. This is an example of predatory pricing.

When the incumbent bundles the regulated service with a non-regulated service, performing the price squeeze test requires detailed cost information of the non-regulated product. Because this product is not subject to regulation, detailed information about the costs is usually not available.

In the NRF, KPN is allowed to offer a bundle of a regulated and a non-regulated service if the incumbent applies one of the two following methods. In the first method the discount that is given on the price of the bundle, compared to the price of the unbundled components, is deducted from the turnover of the unbundled regulated service. The resulting turnover should cover the costs of the regulated service in compliance to the price squeeze test. This method prevents the incumbent from offering a service with bottom price regulation at a price that is too low.

The second method is similar but works in an opposite direction. Here, the discount is deducted from the turnover of the unbundled non-regulated service. The resulting turnover should cover the costs of the non-regulated service in compliance with the price squeeze test.

Both methods make sure that, by deducting the discount from the turnover of a single component, the incumbent is not able to cross-subsidise one component of the bundle using the other. Predatory pricing only occurs when a price is set below cost-price. As long as one of the methods is used, predatory pricing is prevented.

91 ERG, Common position on the approach to appropriate remedies in the new regulatory framework, ERG(03)30rev1, April 2004.
92 Note that the draft decision on the market for retail fixed telephony, in which these tests are introduced, is still pending on the consultation of the market parties at the moment of writing this thesis.
KPN can choose which method to apply. The second method gives the incumbent the possibility of offering a discount at the cost of profits of the non-regulated service. To enable OPTA to check compliance with the price squeeze test, KPN is obligated to ask OPTA’s permission when using the second method. The reason for this is that information about the cost price of the non-regulated product is required, information that otherwise will not be available for the regulator.

There is a third method that is not part of the NRF but which could be appropriate for FMC. This method would be to deduct the discount from the sum of the turnovers of the regulated and the non-regulated service. The resulting turnover should cover the sum of the costs of the regulated and the non-regulated service. This method gives even more space to the incumbent to offer discounts and therefore could be applicable in case of an emerging market or when the bundle is easily replicable by competitors. Using this method, the price of the bundle can be lower than when applying the first or the second method, enabling the incumbent to place the new product in the market using an attractive price, thus convincing as many consumers as possible of buying the product. This can give an innovation just the right push to growth and success. This is only beneficial for the consumer if competitors are easily able to replicate the product and lower the price to a level of that of the incumbent. If not, the competitors would be driven out of the market or hesitate to enter the market and product variety would suffer.

8.3.3 Conclusion
The concern of KPN offering a bundle in which a regulated product could be priced too low, is dealt with in the provisional market analyses of OPTA. The price squeeze methods as described in the previous section ensure that KPN is not able of offering a component of a bundle below cost price. In phase one, when FMC will still belong to the same relevant product market as fixed telephony, and KPN will have SMP on the combined market for fixed telephony and the fixed component of FMC, current regulation will prevent too low pricing.

In phase two, when FMC does not belong to the relevant product market of fixed telephony and no market party with SMP is determined, too low pricing can not be prevented. However, this is not necessarily a problem. The premature nature of FMC might require a light regulatory approach. Restraining the possibilities of KPN in its pricing strategies could obstruct market development towards network integration. Therefore, however the pricing strategy of KPN requires the attention of OPTA in the transition period from phase one to phase two, our recommendation is that too low pricing is not regulated when the market has evolved to phase two: FMC with network integration.

8.4 Monitor consumer protection
In the interviews some issues were mentioned that concern the public interest: transparency, life line services and the quality of service that can be expected from FMC. Other issues that were mentioned were the issue of lawful interception and the obligation of keeping records of voice and data traffic. It can be argued that obligations like this force the operators to make costs, presumably at the expense of innovation. Although it can be acknowledged that these are important issues to both the regulator and the market parties, the relationship with FMC is ambiguous. Therefore these issues will not be part of further analysis in this thesis.

In the following sections, transparency, life line services and the quality of service are discussed.
8.4.1 Transparency

Today, the regulator obligates operators to provide the customer with relevant information about the tariffs they use\textsuperscript{94}. This means that a consumer must be able to find the tariffs with an acceptable amount of effort. The operator is free to interpret this obligation in a way the operator thinks the tariff transparency suffices. Examples are publishing its tariffs on a website, by having an information number where tariff information can be given, etcetera.

Considering FMC, as a result of the changing market and the increase of offerings to the customer, the difficulty of choosing the right operator could increase.

8.4.2 Life line services

Life line services are already discussed in section 8.2.1.3, related to the PN issue. The question was raised whether problems would occur due to the difference in emergency call routing of phone calls originated from fixed and mobile phones. Summarising, when an FMC user has a fixed number, the emergency centre can make the mistake of assuming that the location of the user is known. When the user has a mobile number, calls are not redirected to the emergency centre most nearby, when in fact that would be more efficient.

In this section, the life line services issue is analysed from another perspective. What if in FMC two or more infrastructures are used to deliver voice services, one of which does not offer the possibility of calling the emergency service? When offering services to the customer through several infrastructures, the customer is not always aware of the means by which he or she is connected to its service. This is the result of seamless roaming from one network to another. When lifeline services are provided on one network but not on the other due to asymmetrical regulation, clearly problems could arise.

For example, when a user is connected to a GSM network, he or she has the option to dial an emergency number (‘112’ in Europe) in case of an emergency. The user can expect an answer because mobile operators are obligated to offer emergency services due to regulation. Imagine that the user now roams to a WiFi hotspot, connected to a fixed broadband wire line. If the operator of this connection is not obligated to offer an emergency service, clearly an unlikely situation will occur. The user is not always aware of his roaming to another network, due to the seamless roaming. Therefore a situation could occur in which a user thinks he has access to an emergency service, when that is in fact not the case.

At best, lifeline services should be available on any network that offers voice services. If this is technically impossible or is considered to be too big an obstruction for innovation and hamper competition, at least it should be clear to the consumer when lifeline services are available and when they are not.

To analyse whether problems as described above could actually occur, it is useful to check which voice services are subject to regulation and which are not. Every Public Electronic Communications Service (PECS) is subject to the New Telecommunications Act of 2004 and therefore has to comply to the consumer protection legislation of chapter 7, 11 and 12 of the New Telecommunications Act. Appendix D gives the total list of obligations that a provider of a public telephone service has to comply to.

\textsuperscript{94} Art 3.5 Besluit Universele Dienstverlening en Eindgebruikersbelangen, May 2004.
In Europe, a provider is a provider of a public telephone service if and only if the provider offers the possibility of dialing the emergency number 112 and complies to the additional obligations. In the Netherlands, the NRF differs from the European framework on this matter. Here, a provider of a public telephone service is the provider of a service that enables the consumer to make and receive phone calls. A provider of a public telephone service is obligated to offer the possibility of dialing the emergency number 112 and to comply to the additional obligations.

PSTN, GSM and UMTS all are considered to be PECS. Whether new packet based technologies are also considered to be PECS is somewhat more ambiguous. Concerning packet based voice services, OPTA recognizes five categories (section 3.4.1.2), two of which are subject to general end-user obligations\(^95\): IP telephony and VoIP “on top of” a broadband connection. Table 8.3 shows the different categories of packet based voice services, a description and whether the category is considered to be a PECS.

<table>
<thead>
<tr>
<th>Category</th>
<th>PECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier internal use</td>
<td>No</td>
</tr>
<tr>
<td>VoIP in business networks</td>
<td>No</td>
</tr>
<tr>
<td>Peer to peer Internet telephony</td>
<td>No</td>
</tr>
<tr>
<td>IP Telephony</td>
<td>Yes</td>
</tr>
<tr>
<td>VoIP “on top of” a broadband connection</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Table 8.3: Categories of VoIP and whether they are considered to be a PECS*

Only the last two categories are considered to be PECS and therefore are subject to consumer protection legislation.

As described before, problems with emergency services will mainly arise when two or more technologies are involved, one of which is not subject to regulation. The third category of Table 8.3 could present such a problem. It is possible to use peer to peer internet telephony on a mobile phone, for example by installing software like Skype. Being in category 3, Skype is not subject to regulation and therefore is not obligated to offer lifeline services.

A possible scenario that involves both a regulated and a non-regulated technology is a user calling with peer to peer internet telephony over a fixed broadband connection (extended by Bluetooth or WiFi) and switching to GSM or UMTS when on the move. This scenario seems unlikely, since the same software could also enable the user to make peer to peer internet connections over GSM or UMTS. On the other hand, some mobile operators are investigating the possibility of making it impossible to use such software over their GSM or UMTS network. Nevertheless, innovations in FMC are focused on combining cellular telephony with fixed IP telephony or Voice over Broadband, which are both regulated. Therefore this issue seems to be a non-issue.

### 8.4.3 Quality of service

When unlicensed access technologies like Bluetooth an WiFi become extensions for voice services, quality of service (QoS) becomes an issue. The performance of unlicensed technologies depends on the particular situation in which the technology is being used. Other

technologies nearby can transmit in the same band, thus reducing the performance. Therefore, quality of service can not be guaranteed.

In case of broadband services today, QoS is guaranteed up to the fixed connection at the home. Extending this connection by means of Bluetooth or WiFi is up to the user. The operator takes no responsibility for the quality of this connection. This could change when an operator offers an FMC service. The operator then promises to be able to offer voice service in the home at a lower price but at an acceptable level of QoS. The question is whether this promise is legit.

8.4.4 Conclusion

The concern of reduced transparency to the customer in choosing the right operator can be addressed by helping the consumer to find its way to comparison websites or institutions that protect the consumers’ interest\textsuperscript{96}. Keeping track of the different market parties’ tariffs is not a task that a regulator is able to perform. It is unrealistic to think that a public institution like OPTA can keep track of prices to the same extent that a commercial website can. What the regulator can do, is certify comparison websites that satisfy certain criteria.

Life line services can be dialled on any public telecommunications service. A potential problem is the routing of an emergency phone call to an emergency centre. To avoid that the emergency service misinterprets the location of the caller, the system should be modified. In all emergency service centres, operators should ask the caller for their location. This is a solution on the short term. Technical developments should be monitored since it is expected that future adaptation of GPS in wireless phones will make location information more easily available than is the case today.

In compliance with the Universal Service Obligation (USO) of the New Telecommunications Act, a telecommunications operator with SMP on the market for fixed telephony is obligated to offer fixed telephony with an acceptable QoS at an affordable price to any resident in the country. OPTA, being the authority that checks compliance with the New Telecommunications Act, obligates KPN to offer this service. We find that FMC is no reason to change this obligation nor does it imply that complying will become increasingly difficult for the incumbent.

The quality of service of an FMC offer is of concern to the customer, but it is not a reason for OPTA to intervene. It is expected\textsuperscript{97} that market forces will ensure that operators maintain an acceptable level of QoS.

8.5 If possible, apply regulatory withdrawal

Although a number of concerns, described in the previous sections, arise as a result of FMC, the convergence of fixed and mobile telephony could also be a reason to apply regulatory withdrawal. As the number of horizontally integrated firms emerge, the economies of scope that come with owning both a fixed and a mobile division are no longer the sole benefit of the incumbent. Fixed and mobile operators integrating their networks present strong rivalry for KPN. Moreover, the fact that services can be delivered independent of infrastructure, decreases the competitive advantage of KPN.

\textsuperscript{96} In the Netherlands “de Consumentenbond”.
\textsuperscript{97} This was also one of the outcomes of the GDR session. All participants agreed that QoS will be established by market forces and that regulation is not appropriate here.
When the regulatory challenges of enforcing access, removing entry barriers, preventing anti-competitive behaviour and protecting the end-user are adequately dealt with, a new converged fixed-mobile market could present a level playing field where concentration is considerably lower than on the current markets. This implies that there could be a reason to withdraw regulation as the transition towards FMC with network integration takes place.
9 Conclusions

Using definitions derived from publications and the interviews with market parties, we have constructed the following definition of Fixed-Mobile Convergence:

“Enabling the user to, while using any device, roam and handover seamlessly between a mobile and a fixed network, independent of the access technology that is being used. Handover to another network takes place based on costs, the need for bandwidth, the need for mobility and quality of service. The user can be reached at a single phone number.”

Fixed-Mobile Convergence (FMC) is a technological development that, from the firm’s point of view, can present a way to gain sustainable competitive advantage. Consequently, in line with the Resource Based View theory, market parties develop strategies in order to gain this competitive edge. To truly offer FMC two important tangible resources are necessary: access to a fixed network and access to a mobile network. The degree to which market parties have or can gain access to these resources differs per firm.

We expect the market parties, pursuing resources that give them a sustainable competitive advantage, to do so by acquisition of firms that have complementary resources. Considering FMC, a mobile network is a complementary resource for a fixed operator and a fixed network is a complementary resource for a mobile operator. This means that in their pursuit of resources, firms change market structure towards a more horizontally orientated industry. This confirms the critique of Ferguson (1988) and Wirth and Bloch (1995) that market conduct influences market structure and that causality within the Structure-Conduct-Performance (SCP) paradigm does not run in one direction only.

As a result of the changing market structure, the market parties’ conduct changes. As services can be delivered independent of infrastructure, their focus will shift from infrastructure competition to service competition. Competition will mainly be orientated on innovative services and subsequent product differentiation. In line with SCP, market performance increases as consumers benefit from low prices, product diversity, increased quality and innovative services as a result of the new market structure and conduct.

With the evolution from vertically integrated markets towards horizontally integrated markets, naturally the product characteristics of voice services change also. This has an impact on the relevant product markets defined by OPTA in order to determine SMP and impose remedies. Currently, OPTA has defined a market for mobile telephony and a market for fixed telephony. This distinction is based on functionality and price. Mobile telephony offers mobility: the possibility of travelling large distances while maintaining a connection to the network. This mobility is not offered by fixed telephony. Also, mobile telephony is roughly twice as expensive as fixed telephony, when retail prices are considered.

Although technologies like Bluetooth and WiFi offer a wireless extension of the fixed wire line networks, actual mobility is still not offered. Also there is no indication that the difference in retail prices of fixed and mobile telephony will diminish in the years to come. Therefore we do not expect that the distinction between fixed and mobile telephony, based on functionality and prices, can be abandoned.
FMC raises the question whether an additional market could be defined for this service. We consider two phases of FMC: first, a bundle of fixed and mobile telephony and second, FMC with network integration. The bundle of fixed and mobile telephony provides the consumer the benefits of one-stop-shopping, receiving a single bill, a possible discount and possibly flat rate or flat fee offers. FMC with network integration offers, in addition to the benefits of bundling, the benefit of always utilising the best available radio signal for that time and place, and additional benefits such as roaming between fixed and mobile networks, seamless handover and using one device with one address book and a single phone number.

Because of the prospective character of FMC, the SSNIP test can not be applied in a quantitative sense. Therefore we use a qualitative approach to assess future market definitions. This method uses the following criteria: the extent to which the products are offered and purchased in a bundle; the end-users perception of the separate products being a bundle; the degree to which the products are complementary, substitutes or independent of one another; the price difference between the bundle and its components; and the extent to which the products are purchased in a fixed proportion.

Based on these criteria, we find no reason to define a separate relevant product market for the bundle of fixed and mobile telephony in the first phase. In the second phase however, FMC with network integration, our analysis shows that the extra functionality of the service creates a distinction with both fixed and mobile telephony. Based on the qualitative approach, a new product market for FMC could be defined separate from the product markets for fixed and mobile telephony.

The qualitative approach also provides an indication that an asymmetric market exists in case of FMC with network integration. This means that consumers are willing to switch from either fixed or mobile telephony to FMC based on functionality and price. However, they are not willing to switch back in case of a small but significant increase in price of FMC. This asymmetry is an indication that the markets for fixed and mobile telephony could diminish in time at the benefit of the market for FMC.

This development presents OPTA with a number of challenges. These challenges are generated with the help of interviews with market parties and a Group Decision Room Session. First, the necessity of enforcing access to FMC-specific network facilities of KPN must be assessed in phase two of FMC. Our vision is that a light regulatory approach without access regulation is appropriate. Market parties do not depend on KPN in order to obtain the resources necessary to offer FMC. Moreover, a light regulatory approach ensures that innovation is not hampered. However, would KPN become a market party with Significant Market Power on the retail market for FMC, an access obligation could become necessary to ensure optimal market performance.

Second, in the transition from phase one to phase two, it is important to remove possible entry barriers to the market of FMC. A crucial barrier today is the numbering plan, which does not allow the use of geographical fixed numbers or mobile numbers for FMC services. Another entry barrier, particularly for fixed operators, is the gap between fixed and mobile terminating tariffs and the fixed operators’ corresponding lack of capital necessary to enter the FMC market.
The third challenge for OPTA is to prevent anti-competitive behaviour by the incumbent. In its effort to leverage its market power onto the market for FMC, the incumbent could apply too low pricing or illegal bundling.

The fourth challenge for OPTA is to protect consumer interests in the transition from the current to the new market structure. Special areas that need attention are market transparency, life line services and quality of service.

Finally, OPTA should monitor industry structure developments and look for opportunities to withdraw regulation. The transition towards a horizontally orientated industry structure and the corresponding increased infrastructure independency of services, creates a level playing field in which more market parties are capable of competing with the incumbent. Following the reasoning of the Structure-Conduct-Performance paradigm, this decrease of concentration on the market results in increased market performance. Therefore the necessity of intervention by the regulator could decrease.
10 Recommendations

We recommend that FMC developments be monitored in order to frequently re-evaluate the product market definitions as currently used by OPTA. The transition towards phase two, FMC with network integration, is gradual as the characteristics of the service evolve and functionality matures. Our analysis shows that this transition is likely to present the possibility of redefining relevant product markets. Additionally, when market definitions are re-evaluated, also the geographical aspect of market definitions must be assessed.

In this research we conclude that FMC could present OPTA with an opportunity to withdraw regulation. The opportunities for regulatory withdrawal highly depend on the evolution of the telecommunications industry towards a more horizontal structure. It is recommended that these developments be monitored and that the possibility of regulatory withdrawal be further investigated.

The increase of network integration and possible changing cost structures within the telecommunications industry are likely to have an impact at an international level. Subjects such as international roaming and competition on an international level are not treated in this thesis. Therefore further research on the implications of FMC on an international level is recommended.

Our research provides insights in the regulatory implications of convergence in the specific case of Fixed-mobile convergence. It is recommended that the results of this thesis be used for more general research on the regulatory implications of convergence. The trend of convergence within the telecommunications industry could be a reason to re-evaluate the regulatory framework itself. The theoretical framework used in this thesis can assist in finding shortcomings of the current regulatory framework in dealing with technological change and market dynamics. The methods used can also be adopted in further research. The prospective character of assessing the implications of convergence demands a prospective approach. Both the interviews and the Group Decision Room session proved to be helpful in constructing a vision of the future that is supported by a broad audience of experts.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>3G</td>
<td>3rd Generation</td>
</tr>
<tr>
<td>3GPP</td>
<td>3rd Generation Partnership Project</td>
</tr>
<tr>
<td>ARPU</td>
<td>Average Revenue Per User</td>
</tr>
<tr>
<td>AS</td>
<td>Application Server</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
</tr>
<tr>
<td>BGCF</td>
<td>Breakout Gateway Control Function</td>
</tr>
<tr>
<td>BiBa</td>
<td>Inside area code</td>
</tr>
<tr>
<td>BS</td>
<td>Base Station</td>
</tr>
<tr>
<td>BSC</td>
<td>Base Station Controller</td>
</tr>
<tr>
<td>BT</td>
<td>British Telecom</td>
</tr>
<tr>
<td>BuBa</td>
<td>Outside area code</td>
</tr>
<tr>
<td>CATV</td>
<td>Cable Television</td>
</tr>
<tr>
<td>CPP</td>
<td>Calling Party Pays</td>
</tr>
<tr>
<td>CPS</td>
<td>Carrier Pre Select</td>
</tr>
<tr>
<td>CR4</td>
<td>Concentration Ratio</td>
</tr>
<tr>
<td>CSCF</td>
<td>Call / Session Control Function</td>
</tr>
<tr>
<td>DECT</td>
<td>Digital Enhanced Cordless Telecommunications</td>
</tr>
<tr>
<td>DGTP</td>
<td>Directorate General Telecom and Post</td>
</tr>
<tr>
<td>DSL</td>
<td>Digital Subscriber Line</td>
</tr>
<tr>
<td>EDGE</td>
<td>Enhanced Data rate for Global Evolution</td>
</tr>
<tr>
<td>ERG</td>
<td>European Regulators Group</td>
</tr>
<tr>
<td>ESP</td>
<td>Enhanced Service Provider</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FMC</td>
<td>Fixed Mobile Convergence</td>
</tr>
<tr>
<td>FMS</td>
<td>Fixed Mobile Substitution</td>
</tr>
<tr>
<td>FTA</td>
<td>Fixed Terminating Access</td>
</tr>
<tr>
<td>GDR</td>
<td>Group Decision Room</td>
</tr>
<tr>
<td>GGSN</td>
<td>Gateway GPRS Support Node</td>
</tr>
<tr>
<td>GPRS</td>
<td>General Packet Radio Service</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile communications</td>
</tr>
<tr>
<td>HHI</td>
<td>Herfindahl-Hirschmann Index</td>
</tr>
<tr>
<td>HLR</td>
<td>Home Location Register</td>
</tr>
<tr>
<td>HSDPA</td>
<td>High Speed Downlink Packet Access</td>
</tr>
<tr>
<td>HSS</td>
<td>Home Subscriber Subsystem</td>
</tr>
<tr>
<td>I-CSCF</td>
<td>Interrogating-CSCF</td>
</tr>
<tr>
<td>ID</td>
<td>Identifier (means of identification)</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IETF</td>
<td>Internet Engineering Task Force</td>
</tr>
<tr>
<td>IMS</td>
<td>IP Multimedia Subsystem</td>
</tr>
<tr>
<td>IN</td>
<td>Intelligent Network</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
</tr>
<tr>
<td>kbps</td>
<td>kilobit per second</td>
</tr>
<tr>
<td>KPN</td>
<td>Koninklijke PTT Nederland</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>MAN</td>
<td>Metropolitan Area Network</td>
</tr>
<tr>
<td>Mbps</td>
<td>Megabit per second</td>
</tr>
<tr>
<td>MGCCT</td>
<td>Media Gateway Control Function</td>
</tr>
<tr>
<td>MGW</td>
<td>Media Gateway</td>
</tr>
<tr>
<td>MMS</td>
<td>Multimedia Messaging Service</td>
</tr>
<tr>
<td>MNO</td>
<td>Mobile Network Operator</td>
</tr>
<tr>
<td>MRF</td>
<td>Media Resource Function</td>
</tr>
<tr>
<td>MSC</td>
<td>Mobile Switching Centre</td>
</tr>
<tr>
<td>MTA</td>
<td>Mobile Terminating Access</td>
</tr>
<tr>
<td>MVNO</td>
<td>Mobile Virtual Network Operator</td>
</tr>
<tr>
<td>NCA</td>
<td>National Competition Authority</td>
</tr>
<tr>
<td>NGN</td>
<td>Next Generation Networks</td>
</tr>
<tr>
<td>NMa</td>
<td>Nederlandse Mededingingsautoriteit</td>
</tr>
<tr>
<td>NNO</td>
<td>Nationaal Nummer Overleg</td>
</tr>
<tr>
<td>NRA</td>
<td>National Regulatory Authority</td>
</tr>
<tr>
<td>NRF</td>
<td>National Regulatory Framework</td>
</tr>
<tr>
<td>ONP</td>
<td>Open Network Provision</td>
</tr>
<tr>
<td>OPTA</td>
<td>Onafhankelijke Post- en Telecom Autoriteit</td>
</tr>
<tr>
<td>OSI</td>
<td>Open Systems Interconnect</td>
</tr>
<tr>
<td>PAN</td>
<td>Personal Area Network</td>
</tr>
<tr>
<td>P-CSCF</td>
<td>Proxy-CSCF</td>
</tr>
<tr>
<td>PECS</td>
<td>Public Electronic Communications Service</td>
</tr>
<tr>
<td>PLMN</td>
<td>Public Land Mobile (radio) Network</td>
</tr>
<tr>
<td>PN</td>
<td>Personal Numbering</td>
</tr>
<tr>
<td>POTS</td>
<td>Plain Old Telephone System</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>RBV</td>
<td>Resource Based View</td>
</tr>
<tr>
<td>RPP</td>
<td>Receiving Party Pays</td>
</tr>
<tr>
<td>SCP</td>
<td>Structure-Conduct-Performance</td>
</tr>
<tr>
<td>S-CSCF</td>
<td>Serving-CSCF</td>
</tr>
<tr>
<td>SGSN</td>
<td>Serving GPRS Support Node</td>
</tr>
<tr>
<td>SGW</td>
<td>Signaling Gateway</td>
</tr>
<tr>
<td>SIP</td>
<td>Session Initiation Protocol</td>
</tr>
<tr>
<td>SLF</td>
<td>Subscriber Location Functions</td>
</tr>
<tr>
<td>SMP</td>
<td>Significant Market Power</td>
</tr>
<tr>
<td>SP</td>
<td>Service Provider</td>
</tr>
<tr>
<td>SSNIP</td>
<td>Small but Significant and Non-transitory Increase in Price</td>
</tr>
<tr>
<td>ULL</td>
<td>Unbundled Local Loop</td>
</tr>
<tr>
<td>UMA</td>
<td>Unlicensed Mobile Access</td>
</tr>
<tr>
<td>UMTS</td>
<td>Universal Mobile Telecommunications System</td>
</tr>
<tr>
<td>UWB</td>
<td>Ultra Wide Band</td>
</tr>
<tr>
<td>VLR</td>
<td>Visited Location Register</td>
</tr>
<tr>
<td>VoB</td>
<td>Voice over Broadband</td>
</tr>
<tr>
<td>VoDSL</td>
<td>Voice over Digital Subscriber Line</td>
</tr>
<tr>
<td>VoIP</td>
<td>Voice over Internet Protocol</td>
</tr>
<tr>
<td>WAN</td>
<td>Wide Area Network</td>
</tr>
<tr>
<td>WiFi</td>
<td>Wireless Fidelity (IEEE 802.11)</td>
</tr>
<tr>
<td>WiMAX</td>
<td>Worldwide Interoperability for Microwave Access (IEEE 802.16)</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless LAN</td>
</tr>
<tr>
<td>WLL</td>
<td>Wireless Local Loop</td>
</tr>
<tr>
<td>WLR</td>
<td>Wholesale Line Rental</td>
</tr>
<tr>
<td>WWAN</td>
<td>Wireless Wide Area Network</td>
</tr>
<tr>
<td>xDSL</td>
<td>Any type of DSL</td>
</tr>
</tbody>
</table>
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Fixed-mobile convergence, regulatory implications
Figures and Tables

Figure 1.1: Reading guide: the chapters of this thesis and their consistency............................... 4
Figure 2.1: Structure-Conduct-Performance market paradigm..................................................... 8
Figure 2.2: Levels of concentration............................................................................................. 9
Figure 3.1: Demarcation of fixed and mobile networks............................................................... 13
Figure 3.2: Vertically integrated services.................................................................................... 15
Figure 3.3: Horizontal integration of the transport and service enabling layer............................ 15
Figure 3.4: Different phases of FMC ........................................................................................... 20
Figure 3.5: The GSM/DECT solution of the late 90's................................................................. 21
Figure 3.6: The FMC solution of today....................................................................................... 22
Figure 3.7: Traditional single service networks........................................................................... 22
Figure 3.8: The future telecommunication ecosystem................................................................. 23
Figure 3.9: From legacy circuit switched networks to future packet switched networks ......... 25
Figure 3.10: Five categories of packet switched voice services ................................................. 27
Figure 3.11: GSM architecture including GPRS ......................................................................... 30
Figure 3.12: UMTS architecture.................................................................................................. 31
Figure 3.13: The UMA solution ................................................................................................... 34
Figure 3.14: UMA and GSM/GPRS architecture......................................................................... 34
Figure 3.15: IMS and GSM/GPRS architecture .......................................................................... 35
Figure 5.1: Number of fixed connections in the Netherlands...................................................... 44
Figure 5.2: Average Revenue Per User (ARPU) for fixed and mobile connections of KPN ...... 44
Figure 5.3: Bandwidth and coverage of the different technologies............................................. 48
Figure 5.4: Strategies for fixed and mobile operators................................................................. 50
Figure 6.1: Primary tasks of OPTA ............................................................................................. 53
Figure 6.2: Regulatory process for determining remedies........................................................... 55
Figure 8.1: FTA tariffs of the Dutch fixed network operators ...................................................... 73
Figure 8.2: Call origination, call transfer and call termination ..................................................... 79
Figure 8.3: Why traffic between MNOs is balanced.................................................................... 80
Figure C.1: PSTN architecture.................................................................................................. 113
Figure C.2: GSM architecture ................................................................................................. 113

Table 3.1: Definitions of FMC, obtained from literature .............................................................. 17
Table 3.2: Definitions of FMC, obtained from interviews ............................................................ 18
Table 3.3: Pros (+) and cons (-) of circuit switched and packet switched networks ................. 24
Table 3.4: Technical characteristics per wireless access technology.......................................... 28
Table 4.1: Number of customers and market shares of the Dutch MNOs in 2004 ..................... 38
Table 4.2: The need of each actor for a complementary network .............................................. 40
Table 5.1: Main differences between Wireless LAN and Wireless WAN................................. 47
Table 5.2: Four strategies based on coverage and bandwidth ..................................................... 48
Table 8.1: MTA tariffs of the Dutch MNOs ............................................................................... 73
Table 8.2: MTA tariffs of the Dutch MNOs, as agreed upon in December 2003 ....................... 81
Table 8.3: Categories of VoIP and whether they are considered to be a PECS......................... 90
Table B.1: Pros and cons of different research methods............................................................ 111
Table G.1: Regulatory issues as discussed in the GDR session.................................................. 121
Table G.2: Protocol for GDR session of September 16th 2005 ................................................. 122
Table G.3: Results of the brainstorm session for solutions per regulatory issue .................... 124
Fixed-mobile convergence, regulatory implications
Appendix A: Markets defined by the European Commission

Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation, as recommended by the European Commission in February 2003.

Retail level

1. Access to the public telephone network at a fixed location for residential customers.

2. Access to the public telephone network at a fixed location for non-residential customers.

3. Publicly available local and/or national telephone services provided at a fixed location for residential customers.

4. Publicly available international telephone services provided at a fixed location for residential customers.

5. Publicly available local and/or national telephone services provided at a fixed location for non-residential customers.

6. Publicly available international telephone services provided at a fixed location for non-residential customers.

These six markets are identified for the purpose of analysis in respect of Article 17 of the Universal Service Directive. Together, markets 1 through 6 correspond to “the provision of connection to and use of the public telephone network at fixed locations”, referred to in Annex I (1) of the Framework Directive. This combined market is also referred to in Article 19 of the Universal Service Directive (for possible imposition of carrier call-by-call selection or carrier selection).

7. The minimum set of leased lines (which comprises the specified types of leased lines up to and including 2Mb/sec as referenced in Article 18 and Annex VII of the Universal Service Directive).

This market is referred to in Annex I (1) of the Framework Directive in respect of Article 16 of the Universal Service Directive (“the provision of leased lines to end users”). A market analysis must be undertaken for the purposes of Article 18 of the Universal Service Directive which covers regulatory controls on the provision of the minimum set of leased lines.

Wholesale level

8. Call origination on the public telephone network provided at a fixed location.

For the purposes of this Recommendation, call origination is taken to include local call

---

conveyance and delineated in such a way as to be consistent with the delineated boundaries for the markets for call transit and for call termination on the public telephone network provided at a fixed location.

This market corresponds to that referred to in Annex I (2) of the Framework Directive in respect of Directive 97/33/EC (“call origination in the fixed public telephone network”).

9 Call termination on individual public telephone networks provided at a fixed location.

For the purposes of this Recommendation, call termination is taken to include local call conveyance and delineated in such a way as to be consistent with the delineated boundaries for the markets for call origination and for call transit on the public telephone network provided at a fixed location.

This market corresponds to the one referred to in Annex I (2) of the Framework Directive in respect of Directive 97/33/EC (“call termination in the fixed public telephone network”).

10 Transit services in the fixed public telephone network

For the purposes of this Recommendation, transit services are taken as being delineated in such a way as to be consistent with the delineated boundaries for the markets for call origination and for call termination on the public telephone network provided at a fixed location.

This market corresponds to the one referred to in Annex I (2) of the Framework Directive in respect of Directive 97/33/EC (“transit services in the fixed public telephone network”).

11 Wholesale unbundled access (including shared access) to metallic loops and subloops for the purpose of providing broadband and voice services.

This market corresponds to that referred to in Annex I (2) of the Framework Directive in respect of Directive 97/33/EC and Directive 98/10/EC (“access to the fixed public telephone network, including unbundled access to the local loop”) and to that referred to in Annex I (3) of the Framework Directive in respect of Regulation No 2887/2000.

12 Wholesale broadband access.

This market covers ‘bit-stream’ access that permit the transmission of broadband data in both directions and other wholesale access provided over other infrastructures, if and when they offer facilities equivalent to bit-stream access. It includes ‘Network access and special network access’ referred to in Annex I (2) of the Framework Directive, but does not cover the market in point 11 above, nor the market in point 18.

13 Wholesale terminating segments of leased lines.

14 Wholesale trunk segments of leased lines

Together, the wholesale markets 13 and 14 correspond to those referred to in Annex I(2) of the Framework Directive in respect of Directive 97/33/EC and Directive98/10/EC (“leased line interconnection”) and to those referred to in Annex I (2) of the Framework Directive in
respect of Directive 92/44/EEC (“wholesale provision of leased line capacity to other suppliers of electronic communications networks or services”).

15 Access and call origination on public mobile telephone networks

Referred to (separately) in Annex I (2) of the Framework Directive in respect of Directives 97/33/EC and 98/10/EC.

16 Voice call termination on individual mobile networks

This market corresponds to the one referred to in Annex I (2) of the Framework Directive in respect of Directive 97/33/EC (“call termination on public mobile telephone networks”).

17 The wholesale national market for international roaming on public mobile networks

This market corresponds to the one referred to in Annex I (4) of the Framework Directive.

18 Broadcasting transmission services, to deliver broadcast content to end users.
Appendix B: Choice of method

<table>
<thead>
<tr>
<th>Method</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature analysis</td>
<td>Gives insight in other authors’ opinions and is a prerequisite for research</td>
<td>None</td>
</tr>
<tr>
<td>Delphi</td>
<td>Opportunity to gather a large number of expert insights</td>
<td>Demands availability and willingness to cooperate of all market parties for three or four times</td>
</tr>
<tr>
<td></td>
<td>Possibility of giving feedback on other market parties’ expert opinions and reconsidering one’s own opinion</td>
<td></td>
</tr>
<tr>
<td>Semi-structured interviews</td>
<td>Possibility of making different lists of questions focused on each of the specific interviewees</td>
<td>Can not be used for quantitative analysis</td>
</tr>
<tr>
<td></td>
<td>Can be used for qualitative research</td>
<td></td>
</tr>
<tr>
<td>Group Decision Room (GDR)</td>
<td>Possibility of giving feedback on other market parties’ expert opinions and reconsidering one’s own opinion, though less extensive than in the Delphi method</td>
<td>Demands availability and willingness to cooperate of all market parties at one moment in time</td>
</tr>
<tr>
<td></td>
<td>Can be used for qualitative research</td>
<td></td>
</tr>
<tr>
<td>Questionnaire</td>
<td>Can be used for quantitative analysis</td>
<td>Not optimal and very time consuming for qualitative analysis</td>
</tr>
<tr>
<td>SSNIP (quantitative approach)</td>
<td>Can be used to define a relevant market</td>
<td>Is very time consuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard to apply on a market that is in an early stage of development</td>
</tr>
</tbody>
</table>

*Table B.1: Pros and cons of different research methods*

To retrieve information that is as accurate and up-to-date as possible, an additional method next to literature analysis is sought to consult market parties. Considering the assumed low availability of the market parties during the months July and August 2005 and the qualitative nature of this research, a choice has been made for semi-structured interviews concluded with a GDR session.
Fixed-mobile convergence, regulatory implications
Appendix C: Traditional network technologies

PSTN architecture

![PSTN architecture](image)

**Figure C.1: PSTN architecture**

GSM architecture

![GSM architecture](image)

**Figure C.2: GSM architecture**
### Appendix D: Dutch numbering plan for telephone and ISDN services

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>International access code</td>
</tr>
<tr>
<td>01...</td>
<td>Area codes</td>
</tr>
<tr>
<td>04...</td>
<td>Area codes</td>
</tr>
<tr>
<td>06...</td>
<td>Mobile services and access to data services</td>
</tr>
<tr>
<td>066</td>
<td>Pagers</td>
</tr>
<tr>
<td>06760..</td>
<td>Access to the internet</td>
</tr>
<tr>
<td>07...</td>
<td>Area codes</td>
</tr>
<tr>
<td>08...</td>
<td>Remaining services</td>
</tr>
<tr>
<td>0800...</td>
<td>Free information services</td>
</tr>
<tr>
<td>082</td>
<td>Virtual private networks</td>
</tr>
<tr>
<td>084</td>
<td>Personal assistant services, for both fixed and mobile applications</td>
</tr>
<tr>
<td>087</td>
<td>Personal assistant services, for both fixed and mobile applications</td>
</tr>
<tr>
<td>088</td>
<td>Business numbers</td>
</tr>
<tr>
<td>09...</td>
<td>Remaining services</td>
</tr>
<tr>
<td>0900</td>
<td>Paid information services</td>
</tr>
<tr>
<td>0906</td>
<td>Paid information services</td>
</tr>
<tr>
<td>0909</td>
<td>Paid information services, excluding services of an erotic nature or services with the main purpose to extend the duration of the call</td>
</tr>
<tr>
<td>1...</td>
<td>Special services</td>
</tr>
<tr>
<td>10...</td>
<td>Carrier select services</td>
</tr>
<tr>
<td>112</td>
<td>European emergency service</td>
</tr>
<tr>
<td>118</td>
<td>Subscriber information service that complies to the end-user obligations for providers of a telephony service, with the purpose to provide transparency about the tariffs used by the operator</td>
</tr>
<tr>
<td>12...</td>
<td>Numbers for services that are network-specific&lt;sup&gt;59&lt;/sup&gt;</td>
</tr>
<tr>
<td>131</td>
<td>Can be dialled in front of a phone number to disable number identification</td>
</tr>
<tr>
<td>132</td>
<td>Can be dialled in front of a phone number to enable number identification</td>
</tr>
<tr>
<td>1330 t/m 1399</td>
<td>Numbers for services that are network-specific</td>
</tr>
<tr>
<td>14...</td>
<td>Numbers for services that serve the public interest</td>
</tr>
<tr>
<td>1488</td>
<td>Access to police force emergency service, excluding the emergency service available with 112</td>
</tr>
<tr>
<td>16</td>
<td>Carrier select services</td>
</tr>
</tbody>
</table>

This table is a summary of the original numbering plan. It only contains the phone numbers relevant for this thesis. The original numbering plan can be obtained from the website of the Dutch Ministry of Economic Affairs: [www.minez.nl](http://www.minez.nl).

<sup>59</sup> Consists of numbers that are directly related to the network connection of the customer, for example numbers for customer support, voice dialing and access to voicemail.
Appendix E: Generic end-user obligations

The following generic end-user obligations are derived from the New Telecommunications Act and summarised. These obligations apply to all providers of a public electronic communications service.

Article 4.10 Number portability
Article 6.5 International telephony
Article 7.1 Information provision to consumers
Article 7.2 Modifications and termination of an agreement
Article 7.3 Provision of additional facilities
Article 7.4 Yearly Publication of a Quality of Service report
Article 7.6 Access to a telephone operator and a subscriber information service
Article 7.7 Access to alarm numbers
Article 7.8 Additional rules about information provision
Article 11.2 Protection of personal data and the privacy of subscribers
Article 11.3 Level of security and protection and information provision about the risks
Article 11.4 Bill itemisation and switching of calls
Article 11.5 The processing of communication data
Article 11.5a The processing of locations data
Article 11.9 Number blocking
Article 11.10 Provision of number- and location data to the emergency service centres
Article 11.11 Investigation of annoying or malicious calls (stalking)
Article 11.12 Exemptions
Article 11.13 Exceptions
Article 12.1 Dispute Committee membership
Article 12.9 Settling disputes
Appendix F: The interviews with market parties

Considering the possible confidentiality of the response of the interviewees, a choice has been made not to include the interview reports in this thesis. This approach helped to overcome the market parties’ hesitation to participate with the interviews and to give an open and honest response not influenced by possible strategic considerations. In this appendix an impression is given of the questions asked during the interviews. Remind the semi-structured nature of the interviews. Some questions were more emphasised and elaborated on than others, depending the expertise of the interviewee and the course of the conversation.

General
1. What is your definition of Fixed-mobile convergence?
2. Is FMC part of your strategy in the years to come?
3. What is your interest in FMC?
4. What is your perspective on developments like WiFi and UMTS? Do you consider these technologies substitutes or complements?
5. When will FMC be reality?
6. What barriers for FMC do you see?

Technology
7. What degree of interoperability between fixed and mobile networks do you consider necessary for FMC?
8. Which technologies will make this interoperability possible?
9. Is there consensus on the technology standards that are to be used?
10. How can QoS be guaranteed?
11. The vision of FMC includes personal numbering. How can this functionality be implemented technically?
12. In FMC, how does a caller receive an indication of the price of a phone call?
13. In FMC, is giving location information still technically possible? How?

The market
14. What market structure changes do you expect as a result of FMC?
15. What are the implications of these market structure changes on competition?

Regulation
16. Does current regulation allow FMC? Or are there regulatory barriers?
17. What regulatory issues occur as a result of the changing market?
18. How should the regulator respond to these regulatory issues?
19. How can these regulatory issues be solved?

The input given by the market parties in the interviews was used throughout this report. In this document footnotes are used to indicate the use of information from the interviews.

The following market parties were interviewed:
The incumbent, three mobile owners, three fixed network owners, two service providers and an equipment vendor. The list of interviewees contains employees with functions in the areas of product development, jurisdiction, regulation and wholesale.
Appendix G: Results Group Decision Room Session

On September 16th, 2005, a Group Decision Room session was organised where a group of participants was invited to discuss the regulatory issues that were identified in the previously held interviews. The list of regulatory issues has been assessed on its completeness and possible solutions for the issues were generated. This Appendix gives a summary of the results.

A Group Decision Room (GDR) is a meeting environment in which electronic meeting support is used to help groups address complex problems collaboratively. An important benefit of a GDR session is that participants can submit their contribution to the discussion anonymously, which lowers the barrier to exchange information and to constructively comment on each other’s input. A second benefit is the possibility to enter information in parallel, which speeds up the decision making process.

The following participants were present:

- Representatives from five market parties: KPN, T-Mobile, Vodafone, Tiscali and Versatel, among which were legal councils and product managers;
- Four experts from OPTA on tariff regulation, bundling and numbering within the areas of fixed and mobile telephony;
- Two experts from TU Delft from the sections Information- and Communication Technology (ICT) and Economics of Infrastructure (IE), respectively.

Disclaimer: The representatives of market parties provided their input on their own personal account. Their opinions do not necessarily reflect the opinions of their company.

The session was facilitated by Jaco Appelman and Sandra van der Hulst from TU Delft.

The following list of regulatory issues that were subject of the discussion in the session were sent to the participants a week in advance:

<table>
<thead>
<tr>
<th>Personal numbering</th>
<th>Terminating tariffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbering plan</td>
<td>Gap between fixed and mobile terminating tariffs</td>
</tr>
<tr>
<td>Price indication of a phone call</td>
<td>Handset subsidies</td>
</tr>
<tr>
<td>Numbers for personal assistant services</td>
<td></td>
</tr>
<tr>
<td>Number portability</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leverage of market power</th>
<th>Consumer protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross subsidisation</td>
<td>Transparency</td>
</tr>
<tr>
<td>Bundling</td>
<td>Emergency services</td>
</tr>
<tr>
<td></td>
<td>Quality of service</td>
</tr>
</tbody>
</table>

Table G.1: Regulatory issues as discussed in the GDR session

The following protocol was used in the session. In the column on the right the so-called GDR “think-lets” or system instructions that were used are mentioned for readers that are familiar with GDR support systems.
### Introduction to Fixed-mobile convergence by Tijmen Pardijs

- Duration: 15 minutes
- System instructions: DOP categoriser

### Introduction to the GDR by Jaco Appelman

- Duration: 15 minutes
- System instructions: DOP categoriser

  Including the warm-up question: "How to persuade a Minister to listen"

### Brainstorm for solutions for the regulatory issues

- Duration: 30-45 minutes
- System instructions: DHL categoriser with buckets:
  - Personal numbering
  - Terminating tariffs
  - Leverage of market power
  - Consumer protection

  Here, the participants can formulate solutions per regulatory issue. It’s also possible to comment on each other’s input.

### Structuring the solutions and evaluation of the regulatory issues

- Duration: 40-60 minutes
- System instructions: CBW

  Here, irrelevant and double solutions are eliminated and the solutions are categorised and grouped per regulatory issue.

### Estimate the time necessary to implement the solution

- Duration: 20 minutes
- System instructions: EMC scale 5 points Likert

  Each solution was assessed on a five point time scale from (1) very little to (5) very much time.

### Estimate the costs involved to implement the solution

- Duration: 20 minutes
- System instructions: EMC scale 5 points Likert

  Each solution was assessed on a five point cost scale from (1) very low to (5) very high costs.

### Which solutions should be implemented?

- Duration: 15 minutes
- System instructions: Yes/No vote

### Survey and conclusion by Tijmen Pardijs

- Duration: 10 minutes
- System instructions: 

---

**Table G.2: Protocol for GDR session of September 16th 2005**

Table G.3 gives the results of the brainstorm for solutions per regulatory issue after structuring them and evaluation of the regulatory issues in the session itself. Note that, even after evaluation, there still are solutions in the list that are fundamentally equal to one another. Apparently completely eliminating double input is not succeeded in the session.

#### Personal numbering

<table>
<thead>
<tr>
<th>Numbering plan</th>
<th>1</th>
<th>Use 088 numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>Introduce new number range</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Don’t introduce personal numbering</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Abandon distinction between fixed and mobile numbers</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Introduce new number range for consumers comparable to 088</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Make numbering plan technology neutral</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Introduce new number range</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Obligate number portability between fixed and mobile users</td>
</tr>
</tbody>
</table>

#### Price indication of a phone call

<table>
<thead>
<tr>
<th>Price indication of a phone call</th>
<th>9</th>
<th>Tariff indication, on screen or by spoken message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>The caller pays the lowest tariff, i.e. the fixed tariff</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Introduce Called Party Pays principle</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>When FTA and MTA tariffs balance, this is a non-issue</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Regulate MTA tariffs to a cost-based level</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Lower MTA tariffs</td>
</tr>
<tr>
<td>Appendix G: Results Group Decision Room Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers for personal assistant services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Let the receiving party pay the difference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Don’t do anything, the reputation of these numbers will improve in the long run</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 088 shows that using these numbers can work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number portability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Adapt COIN to enable fixed-mobile number portability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Change legislation in order to enable fixed-mobile number portability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 The possibility of using fixed geographical numbers within mobile networks is limited without MSISDN (with respect to roaming and SMS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Create a technical layer in the networks that facilitate routing independent of the number used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Stimulate the evolution towards one standard terminating tariff for both fixed and mobile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 By regulation towards a cost-based level the difference between MTA and FTA will diminish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Changing cost-structure to either receiving party pays or flat fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Introducing user profiles to enable flat fee propositions is difficult due to strategic behaviour of the customer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Terminating tariffs**

<table>
<thead>
<tr>
<th>Gap between fixed and mobile terminating tariffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 Let the subscribers of the mobile network pay for the marketing activities of the MNO instead of the fixed users through MTA tariffs</td>
</tr>
</tbody>
</table>

**Handset subsidies**

<table>
<thead>
<tr>
<th>Competition increases when handsets and services are offered separately</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 Competition increases when handsets and services are offered separately</td>
</tr>
<tr>
<td>28 Handsets are paid for through subscription tariffs, there is no such thing as handset subsidisation from MTA</td>
</tr>
<tr>
<td>29 This is a non-issue. Fixed operators can apply handset subsidisation too</td>
</tr>
<tr>
<td>30 Prohibit handset subsidisation, just like in other European countries</td>
</tr>
<tr>
<td>31 “Subsidisation” of terminal equipment is applied in more areas than mobile handsets only (decoders, modems) and is primarily applied to lower entry barriers for customers. This situation is not necessarily a threat but first and foremost beneficial to the consumer</td>
</tr>
<tr>
<td>32 Subsidisation of “dual mode” handsets (compatible with both fixed and mobile networks) is the key to success for FMC</td>
</tr>
</tbody>
</table>

**Leverage of market power**

<table>
<thead>
<tr>
<th>Cross subsidisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 Prohibit KPN from bundling</td>
</tr>
<tr>
<td>34 Obligate KPN to give insight in the cost structure of the bundle</td>
</tr>
<tr>
<td>35 Enable other market parties to make a comparable offer</td>
</tr>
<tr>
<td>36 Impose an accounting separation for the operator with SMP. In the draft decision for the retail market for fixed telephony, OPTA has constructed a regulatory model that is appropriate for this issue</td>
</tr>
<tr>
<td>37 When determining the lower boundary of the price, use the market price for mobile only as input</td>
</tr>
</tbody>
</table>

**Consumer protection**

<table>
<thead>
<tr>
<th>Transparency</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 Comparison websites deal with this issue</td>
</tr>
<tr>
<td>39 Certify comparison websites</td>
</tr>
<tr>
<td>40 FMC could just as well improve the transparency of the market due to flat fee</td>
</tr>
</tbody>
</table>

123
Fixed-mobile convergence, regulatory implications

offers and the diminishing of the difference between fixed and mobile tariffs

41 Transparency increases when one tariff is used

Emergency services

42 Let all emergency calls be processed by one central emergency service centre
43 Obligate all providers of voice services to provide 112 services (Skype too!)
44 Localisation information based on phone numbers is outdated. New technologies should provide a solution
45 All providers of voice services are already obligated to provide the 112 emergency service. The problem is whether location information will be processed correctly
46 Wait for the technology of tomorrow to solve this issue
47 Obligate all providers of voice services to provide location information

Quality of service

48 Demand a standardised Quality of Service guarantee
49 Leave to market forces

Table G.3: Results of the brainstorm session for solutions per regulatory issue\textsuperscript{100}

\textsuperscript{100} Freely translated into English by the author.