ERG (09) 06

REPORT ON FIXED-MOBILE CONVERGENCE:

IMPLICATIONS ON COMPETITION AND REGULATORY ASPECTS

March 2009

Table of contents

EXECUTIVE SUMMARY

In general, convergence at the network level can be understood as being able to offer a customer mobile and fixed (or fixed-like) services seamlessly by integrating fixed and mobile networks. However convergent products exist also where there is no convergence at the network level; ñfixed-likeò services can be provided when end users are connected via a particular cell defined as the ñhome cellò or ñhome zoneò typically coinciding with the 2G or 3G cell.

In order to provide such convergent services, mobile operators are able to use their own network, and do not require convergence at network level (home zone solutions). This is not the case for fixed operators, for whom it is essential to have access to a form of mobile network to provide the same solution. Fixed operators would therefore need to play the role of MVO (Mobile Virtual Operator).

Different architectures to deploy FMC services are presented in this paper. The possibility for different MVOs to compete in providing such services is also considered. In addition, each architecture has different implications for end users, in terms of numbering and retail prices for both incoming and outgoing calls.

As outlined in the following sections, the possibility to offer convergent services depends strongly on the type of business model adopted by a MVO. Actually, four categories of MVO can exist, each with different levels of functionality as a convergent operator.

The paper also considers substitution trends between fixed and mobile traffic services across European countries. The data presented shows that, besides the retail price, several other factors need to be considered, for example culture, habits, QoS, telecom development in each EU-Country, percentage of bundled offers available, etc.

Although mobile has the inherently desirable characteristic of mobility, there is some resistance to full substitution, in part due to the provision of broadband services by fixed providers. This has changed the competitive force of fixed access. Fixed operators get higher or stronger loyalty from their customers, because they demand other services offered by fixed lines, especially broadband. Mobile operators appear to not yet have sufficiently strong alternatives to facilitate full fixed and mobile substitution.

A number of competition issues are addressed in the paper, in particular the possibility that fixed operators may be at a disadvantaged in offering fixed-mobile convergent products since they require MVNO agreements to provide convergent services in the same way as a mobile operator. Also discussed is the effect that asymmetry between mobile and fixed termination rates may have on profitability and margins as fixed mobile convergent services become widely adopted.

1 FMC products description

Generally speaking, convergence suggests the ability of a fixed or mobile operator the ability to offer mobile and fixed (or fixed-like) services seamlessly to the customers. In this situation, a mobile network operator (MNO) can provide fixed (or fixed-like) access and a fixed network

operator (FNO) can provide mobile access, with the intention of providing both services to a consumer in a single device.

In the following sections, a distinction is established between convergence achieved at the network level or at an alternative (e.g. service) level. In addition four architectures are identified that permit the implementation of FMC services, and finally an overview of NRAs on FMC services currently available across Europe is presented.

1.1 FMC convergence modalities

No convergence at network level

This kind of FMC is based on the provision of a ñfixed-likeò rate when the end user is connected via a cell defined as the ñhome cellò or ñhome zoneò, typically coinciding with the 2G or 3G cell. Geographic numbering for incoming and outgoing calls can be used, in a way that this service becomes indistinguishable from fixed telephony when the user stays within their ñhome zoneò. Such service is typically offered by MNO (Mobile Network Operators) but, MVO (Mobile Virtual Operators) could also provide it. In this case the Quality of Service (QoS) for the ñfixed-likeò service is the same as for the mobile service.

Convergence at network level

Convergence at network level requires integration of fixed and mobile networks, in order to supply convergent services to customers. Technical solutions that permit such integration are i) Wi-Fi (typically) or Bluetooth microcells at home, ii) FemtoCells at home and iii) VoIP on a mobile broadband (internet) connection.

To date, most convergence at network level relies on the usage of Wi-Fi microcells at home (Bluetooth connections are nowadays rarely used for such kind of service). Three kinds of operators can potentially offer such convergent services:

a) MNOs, which can provide fixed access via regulated unbundling and bitstream

b) Integrated fixed and mobile operators; and

c) Fixed operators, which can provide mobile access by playing the role of MVOs by accessing commercial offers provided by MNOs.

In order to provide convergent services, whereas mobile operators have the possibility to exclusively make use of their own network, thus not requiring convergence at network level (home zone solutions), fixed operators require an MVO agreement with a mobile operator. Such operators can provide convergent services either via ñhome zoneò solutions or more likely by integrating the mobile access with their own fixed network (solution based on Wi-Fi microcells at home).

However, the possibility to offer convergent services strongly depends on the type of business model adopted by a MVO. In fact, four categories of MVO can exist, each with a different level of functionality as a convergent operator:

a) ***Full MVNO (or simply MVNO- Mobile Virtual Network Operator)*:** The MVNO owns the same processes and platforms as the MNO (Mobile Network Operator), with the exception of the Access Network (radiofrequency base stations), because it does not have a license relative to radio frequency spectrum utilization. As a consequence, in order to provide the same MNO services, the MVNO must utilize the MNO access Network. It is important to note that the Full MVNO manages the switching, the transport and the termination of calls,

including the localization of users, and, by owning a telephone number range, provides the SIM to the final users.

b) ***ESP (Enhanced Service Provider)*:** The ESP owns the same platforms and processes as the Full MVNO with the exception of the parts that provide the user's localization and, then, realize calls termination. It may, or not, manage the switching and the transport of calls. The ESP does not own a telephone number range and then does not provide SIM to the final users.

c) ***DSP (Data Service Provider)*:** It has the same characteristics as the previous model except from the fact that it provides telecommunication services excluding 2G/3G telephony service.

d) ***SP (Service Provider)*:** The virtual operator activities are very few and are related to the marketing and sale, and its activities are the typical ones of a reseller operator. SIM cards are not owned but customized by the virtual operator's brand.

An illustrative description of the elements owned or managed directly by the virtual operator is provided in the following table:

Elements owned/managed by the MVO	**MVO Typology**			
	SP	ESP/DSP	Full MVNO	MNO
Frequency spectrum	NO	NO	NO	YES
HLR and user's localization	NO	NO	YES	YES
Mobile network infrastructures (switching and transport)	NO	YES[1]	YES	YES
SIM card	specific brand on hosted SIM	specific brand on hosted SIM	YES	YES
Customer Care and billing	YES	YES	YES	YES

Table 1. MVO's typologies

The DSP MVNO does not offer telephony services, and as such this model is, in principle, not useful in providing convergent telephony services (with some exceptions as explained later). The SP MVNO is less suitable than the hosting MNO in providing innovative services.

Based on these descriptions, convergence at network level can be realized by the following:

a) Integrated fixed and mobile operators.

b) Fixed operators which are also ESP (convergent ESP).

c) Fixed operators which are also Full MVNO (convergent Full MVNO).

[1] An ESP/DSP may own a partial or complete switching infrastructure.

1.2 Architectures to implement FMC services

There are four possible different architectures in implementing Fixed Mobile Convergent services that have been identified:

1) **Convergence within the handset.** The end-user uses a mobile 2G or 3G handset that is connected to domestic Wi-Fi or DECT network at home; the network can recognize if the handset is on the mobile or on the fixed network.

2) **Installation of a femtocell at the end-userôs home,** that is connected to the network via broadband access and subject to a fixed-like tariff scheme when the user remains at home.

3) **Offer of a fixed-like rate,** when the end-user is connected via a cell defined as the ñhome cellò, whose coverage area defines the ñ**home-zone**ò.

4) **VoIP on a mobile broadband internet connection**. In this case there is no usage of mobile numbers and the VoIP provider ignores whether the call is routed via fixed or mobile networks.

Current FMC systems are implemented based on the above architectures, with some possible minor modifications. Each of the referred architectures is not accessible under the same conditions by every kind of operator, as explained below:

Architecture 1) can be provided by MNO by using unbundling or bitstream access and by FNO either as ESP (but routing is under control of the wholesale MNO, when using mobile numbering for incoming calls) or full MVNO.

Architecture 2) can only be provided by MNO.

Architecture 3) can be provided by MNO without any fixed access and by full MVNO (to be able to localize users for billing purposes).

Architecture 4) can be provided by FNO as any type of MVNO with data services; it does not make sense for MNO.

The following paragraphs provide a deeper description of each of the referred architectures and the technical and commercial implications on different types of operators.

1.2.1 Convergence within the handset (Wi-Fi microcells at home)

This solution is based on the use of dual mode (GSM-Wi-Fi or UMTS-Wi-Fi) terminals realized in UMA (Unlicensed Mobile Access) technology. Such technology allows the dual-mode handset to provide access to 2G/3G mobile services over unlicensed spectrum technologies. Such terminals typically employ a Wi-Fi connection and VoIP technology when the user is at home or in the coverage area of specific operatorôs hot spot (ñindoorò mode). In ñoutdoorò mode, the terminal is connected to the mobile network and GSM (or UMTS) technology is employed. The following figure shows the UMA Network architecture:

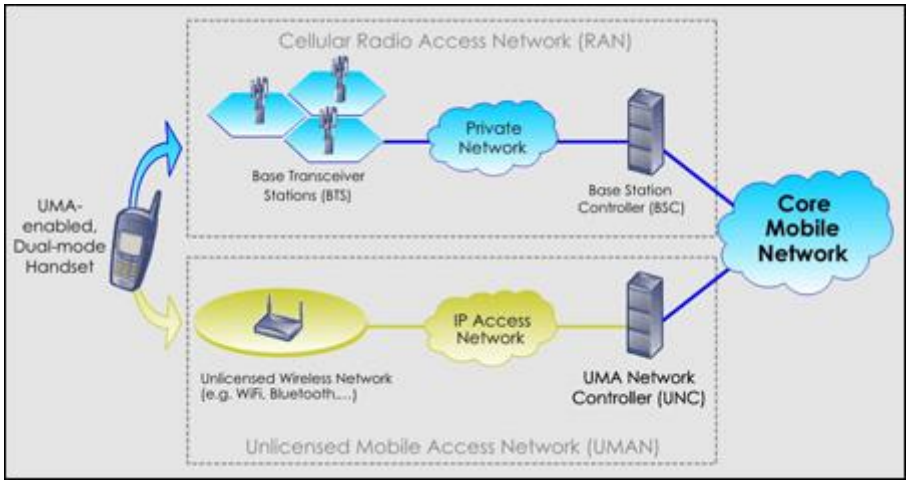


Fig. 1. UMA Network Architecture

In indoor mode fixed-like tariffs are normally applied, whereas in outdoor model the service becomes equivalent to a mobile service and then the tariffs are higher. From a technical point of view, it is relevant to observe that the terminals are able to automatically switch from indoor mode to outdoor mode and vice-versa. Two working modes are possible:

- The handset switches to the Wi-Fi home station to generate outgoing calls and switches back to mobile at the end of call to be able to receive calls. Thus, incoming calls are always routed via mobile network and synchronisation between mobile voice and VoIP networks is not requested.
- The handset switches to the Wi-Fi home station when available, so that the network recognizes it and is capable of routing incoming calls through the Wi-Fi station. For incoming calls, the mobile network is able to localize the terminal by accessing to HLR (Home Location Register). If the terminal is in outdoor mode, the call is switched in the mobile network toward the appropriate BSC (Base Station Controller); if the terminal is in indoor mode, the call is switched toward the MSC (Mobile Switching Centre) where the UNC (Uma Network Controller) is connected, and from there the call is switched to the terminal via IP network.

For integrated MNO and FNO such technology represents an opportunity to offer a convergent service to its customers, as a simple extension of the fixed telephone service, with the advantages of having lower costs, a unique invoice, a unique terminal and a higher quality of the service inside buildings where mobile coverage is relatively poorer.

For Fixed operators which are also ESP (convergent ESP) or Full MVNO (convergent Full MVNO) such technology represents an opportunity to provide mobile services to its fixed customers, or acquire new costumers from the mobile telephony market.

On the basis of such considerations, it is evident that a convergent MVNO can realize convergent services only if it is able to establish the location of the terminals. Convergent Full MVNOs are able to access the location information of terminals and therefore provide convergent services with a high grade of efficiency, flexibility and personalization.

The full MVNO model has the opportunity to raise greater profits (in particular because it allows to retain the termination fees), and opportunities for innovation. Convergent ESPs, can access location information of terminals only via the host MNO and as such the opportunity to offer convergent services depends also on the MNOôs network and its functionalities.

ESP MVO has a lower grade of flexibility in realizing convergent services, and in general less opportunities to make profits and be competitive in the market; this is true especially for ESP with few infrastructures. As a consequence, convergent Full MVNO is a more interesting model from a market point of view; however, it has to be considered that such model requires more investments and carries higher capital risks than simple ESP MVNOs.

1.2.2 FemtoCells at home

Femtocells are used as an efficient solution to increase indoor coverage for existing voice and high-speed mobile data services, but they also represent a basis for the development of FMC services.

A femtocell is a small cellular base station that provides wireless access with limited coverage and user capacity. They are connected to the Internet via an end-user owned broadband backhaul (cable, DSL or fibre) to support wireless voice and data traffic. In short, when the userôs terminal is outside the coverage of the userôs femtocell, its traffic is carried by the wide-area cellular network and, when it is under the coverage of the femtocell, the traffic is carried via the Internet connection.

Femtocells provide various voice and data services based on 3G cellular standards (CDMA2000, UMTS, UMB, LTE) or also on WiMax standard; the end-user device takes a femtocell as a standard base station, and there is no required change on mobile devices, and legacy handsets operate seamlessly. Femtocells are basically extensions of the operatorôs cellular networks, and can be configured to provide unrestricted access, or restricted access, to a group of registered users.

A femtocell has limited transmission power and typically supports no more than 5-8 users; moreover, its deployment would not require planning and any manual configuration. As a result, it can be easily deployed by end users to provide coverage at home or enterprise environments.

From the operatorôs point of view, femtocells enable operators to meet market demand and improve profitability, in terms of: i) better indoor coverage, especially for networks deployed at higher frequencies, ii) better capacity gains, obtained off-loading traffic from the cellular wireless networks, iii) lower backhaul costs, obtained by moving backhaul traffic to locally provided DSL or cable connections, iv) new services, e.g. integrated fixed-mobile bundled services covering voice, data and video.

From the end-userôs point of view, femtocells enable customers to achieve all the benefits of a converged network, that is mobile communication outside the home and fixed-like tariffs and quality of services at home (the last aspect can be remarkable especially for data services). The main advantage for the user, concerning the solution ñWi-Fi microcells at homeò, is the use of a normal 3G handset (not requiring any expensive modification or customization) which becomes the only device that he needs for communication anywhere. The integration of this technology in broadband routers could accelerate the acceptability of this solution by end-users. However, it must be noted that only MNO can provide such kind of services.

1.2.3 Offer of a fixed-like rate (Home-zone)

The architecture of such offers relies fully on the mobile network. Two possible models exist:

- Pure mobile service with mobile number only. Customers benefit from fixed like rates in outgoing calls inside the ñhome zoneò, but the number remains a mobile number. Therefore, all incoming calls are priced at mobile terminating rates by the operator of the calling party.
- Usage of two different numbers: a fixed geographical number when the mobile phone is in the ñhome zoneò and a mobile number when the mobile phone is outside the ñhome zoneò. The Mobile Network recognizes if the user is in the ñhome zoneò and makes the association

with the fixed number. When the user is in the ñhome zoneò, they benefit from fixed rate prices for outgoing calls. The fixed number service allows the customer to manage in a flexible way the calls directed to his home fixed number. The customer could make use of an ñavailabilityò service which make possible for the user to answer incoming calls also outside the ñhome zoneò, or he can choose to activate the reception of such calls only in the ñhome zoneò. Outside the ñhome zoneò the customer can receive notification of calls incoming on the geographical number for example via a secretary service or a short message service.

Such services could be provided by MNO without any fixed access and by full MVNO, given their capacity to localize users for billing purposes.

1.2.4 VoIP on mobile broadband

VoIP services are becoming more common as electronic communications services are shifting to IP-based networks. VoIP based Telephony services, when identified as Public Electronic Communications services, may be the future for telephony services, replacing traditional PSTN telephony services.

Usually the VoIP-based services are named on the base of the underlying transport technology, i.e. Voice over broadband (VoB) or VoIP over mobile (VoWLAN, Vo3G, VoWimax), etc. Users may access through ADSL, cable modem, Wi-Fi, WLAN, 3G or other broadband IP connections across a variety of VoIP terminals. These include IP-phones, soft phones running on PC or PDA, Smart mobile-phones, POTS with adaptors (ATA) or Dual Mode (GSM+WLAN) mobile phones.

ERG took a step forward with its ñCommon Position on VoIPò and the corresponding consultation in late 2007. The CP classified potential VoIP products in 4 categories, regardless of the transport technologies or customer segments, from the accessibility point of view. This classification allowed to set-up a clear distinction between telephony services that may require some regulation and other services that are out of scope of the current regulation.

Service category	Outgoing access to PSTN	Incoming access from PSTN	E.164 number provided	Type of service
Service 1	×	×	×	Peer-to-peer
Service 2	✓	×	×	VoIP outbound services
Service 3	×	✓	✓	VoIP inbound services
Service 4	✓	✓	✓	Voice telephony

Table 2: ERG CP on VoIP, VoIP services classification

The ERG common position also defined that there are many IP based voice services/applications usually offered via the Internet (call back services, click to dial, real-time chat services, voice blogging and so on) that do not fall within the categories 1ï 4. Even when these services may be generated by voice over IP in a literal meaning, they are clearly not telephony services strictest sense and in respect to the above mentioned definition, as they do not allow any to any communication by originating and/or receiving national and international calls, and by using a number or numbers in a national or international numbering plan. These services should not be subject to regulation of telephony services.

Another aspect related to QoS deals with the providerôs capacity to ensure for VoIP services a level of quality comparable to that of a traditional PSTN voice service. From this point of view, a general

understanding is that an acceptable level of QoS can be provided only in case of ñmanagedò VoIP services, i.e. when the service provider also offers to the customer the broadband access and then can be able to control the quality of the service.

In our analysis we will consider managed and unmanaged VoIP services that fall within category 4.

1.3 FMC services currently available across Europe

This section is based on the information provided as an answer to the questionnaire[2] circulated among NRAs. The following paragraphs summarise the aspects related to the description of the FMC services currently available in Europe.

1.3.1 Type of implementation

Almost all NRAs pointed out the existence of FMC commercial services, with the exception of three countries (Estonia, Turkey and Switzerland) where such services are not offered yet. The most common implementations of commercial FMC offers are based on the following architectures:

- Convergence within the handset (case n. 1)
- Fixed-like rate (case n. 3)

Operators offering such services are mainly ñpureò mobile operators, but in some cases the service is offered also by integrated Fixed Operators and MVOs.

Regarding case n. 1, it is worth to note that some of the existing implementations are based on an extension of the ñclassicò Wi-Fi connection available at private location (the ñhomeò area). In fact, such solutions could include also public hotspots (managed by the operator) to extend the coverage where it is possible to use convergent services.

VoIP solutions for FMC services are operating in some European countries (actually 3 countries). Spain is the only country where a FMC service based on Femtocells has been developed, although it is only in a trial phase (not yet commercial).

1.3.2 Usage of fixed and/or mobile numbers, in both incoming and outgoing calls

In the case of architecture n. 1 (convergence within the handset), numbering used in outgoing and incoming calls is typically only mobile.

In the case of architecture n. 3 (fixed-like rate), numbering used in incoming and outgoing calls can be both geographical and mobile.

French Mobile VoIP service utilizes SIP address or freebox number and users can receive calls to their fixed line on their mobile handset, while UK VoIP service utilizes mobile numbering.

1.3.3 Retail rates characterization

Some open questions, raised when comparing different FMC products and their opportunities to become competitive on the retail market, are concerned with the retail rates that are charged to the end users, in particular if compared with traditional fixed services. Although many differences are present between different products and different countries, some general conclusions may be made.

[2] The questionnaire was answered by NRAs of the following countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Italy, Poland, Portugal, Romania, Slovenia, Spain, Switzerland, Turkey and United Kingdom.

Concerning outgoing calls rates, they depend strongly on the type of product but also vary with the tariff plans for the same product. In general it can be said that, in the majority of cases, different rates for outgoing calls originated from inside and outside the ñhomeò area are applied; this is, for customers, one of the most attractive characteristic of FMC services: its lower rates when calling from a fixed-like terminal respect to a pure mobile one. Such a feature is valid for the different FMC architectural solutions we have considered, in the sense that in case of solution 1 the ñhomeò area is represented by the Wi-Fi-covered area, in case of solution 2 it is represented by the area covered by the femtocell, in case of solution 3 it is represented by the area covered by the ñhome cellò. Moreover, for solutions based on Wi-Fi technology (UMA), in some cases calls are free of charge (for example between UMA devices or for calls toward national geographic numbers). However, not all of these considerations apply in case of VoIP services.

There is a second aspect regarding incoming calls rates: when the FMC service employs a geographic number for incoming calls, it can happen that the mobile network is utilized to terminate the call (when the user is at ñhomeò, or when the user is outside the ñhomeò and redirection is activated on the mobile number). In all the products considered, incoming calls rates remain equivalent to that toward fix network for the originating users; however, in three countries it happens that an extra charge for the end user is required to receive calls on geographic number when the user is outside the ñhomeò location.

1.3.4 Technical services and peculiarities

There are other aspects that impact on the possibility for a FMC service to become a valid substitute of traditional fixed and mobile services, stimulating or limiting the spread of such services. In particular regarding number portability, in all countries where a FMC product using geographic numbering is active, it is feasible that the user keeps its fixed number when passing to the FMC service, with some limitations in countries where number portability is not already fully applied. Instead, for what concerns the possibility to originate emergency calls from a FMC terminal, this is possible for all the FMC products except for VoIP-based ones and for one specific product based on Wi-Fi (solution 1).

1.3.5 Singularities

In some countries there are bundled offers which integrate mobile and fixed services, but with two different handsets and using different networks (mobile and fixed separately); in Denmark there is a specific product where such bundle is also combined with a call redirection service between the two handsets. In general, these bundles are not FMC services in the sense we have defined them and will therefore not be considered in such analysis.

Concerning solution 1, in France we can find two products that work through the Wi-Fi connection available at private location (the ñhomeò area in our meaning), but also on public hotspots (managed by the operator); this is an extension linked to our definition of Wi-Fi microcells at home.

Finally, the case of VoIP services (solution 4) deserves some specific considerations. Only in three countries there are products based on VoIP (over Wi-Fi or 3G technology) that have been considered as potential FMC services; however, they are very different from other FMC products, because they usually use a specific geographic numbering. Therefore number portability is not possible, and emergency calls are not always guaranteed.

1.3.6 Number of users of FMC services

Only three countries have provided data about the number of customers of FMC services. It is not therefore possible to make an analysis of this. However, the lack of information seems to be related mostly to the fact that such services are in their initial stage of development, with some only in a trial stage.

2 Substitution trends. Access and traffic

There appears a high chance that substitutability from current fixed voice services to new FMC services will happen in the mid to long term; however it is premature to assert that such phenomenon implies a quick substitution of current services by the new convergent technologies. It is a complicated scenario that requires full examination and monitoring; not quick hypothesis. It is reasonable therefore to take account of some aspects related to the characteristics of the access and traffic markets.

It is essential to highlight the fact that the increase of the broadband penetration has changed the competitive force of fixed access. Fixed operators get higher or stronger loyalty from their customers, because they demand other services offered by fixed lines, especially broadband. In these cases mobile technologies can not offer products competitive enough to facilitate substitution between fixed and mobile accesses.

However, it must be remarked that most fixed accesses do not include any kind of bundle, what is a characteristic that can be found in a high number of countries (e.g. in Spain, of a total amount of thirteen million lines, more than seven million lines access exclusively to the voice service not being associated to any bundle).

According to the following data from the last E-Communications Households Survey[3], almost all households in the EU27 (95%) have now access to a telephone (either a mobile phone, a fixed-line phone or both).

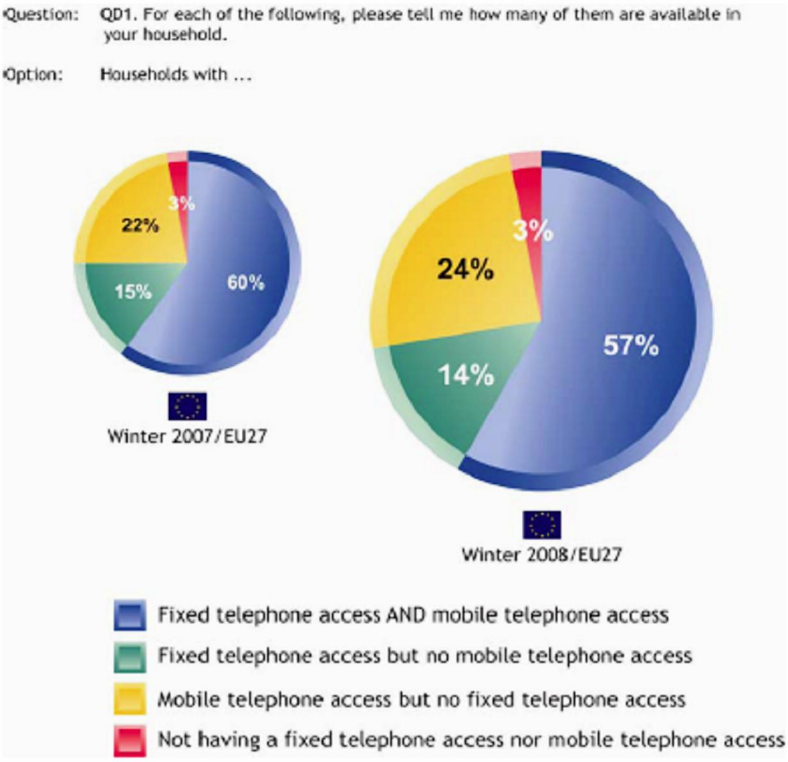
The majority of European households have both fixed and mobile telephone access (57%). The largest proportions of households with dual-access are to be found in Sweden, Luxembourg, Malta and the Netherlands. On the other hand, fixed-only access is the most widespread in Bulgaria, Germany and France, while the highest numbers of mobile-only households are to be found in the Czech Republic and Finland.

The reason of having more fixed or mobile lines depends on many factors, such as regulatory measures, investments, maturity of the markets, extension of fixed networks and time of development of mobile ones, etc.

In the following graphic of the E-Communications Household Survey a constant trend in telephone and mobile access can be observed among 2007 and 2008. The number of households having mobile telephone access but not fixed increases in 2% while the number of households having only fixed telephone access but not mobile decreases in 1%. In any case, it is difficult to assess if the increase in mobile telephone accesses corresponds to the decrease in fixed telephone ones.

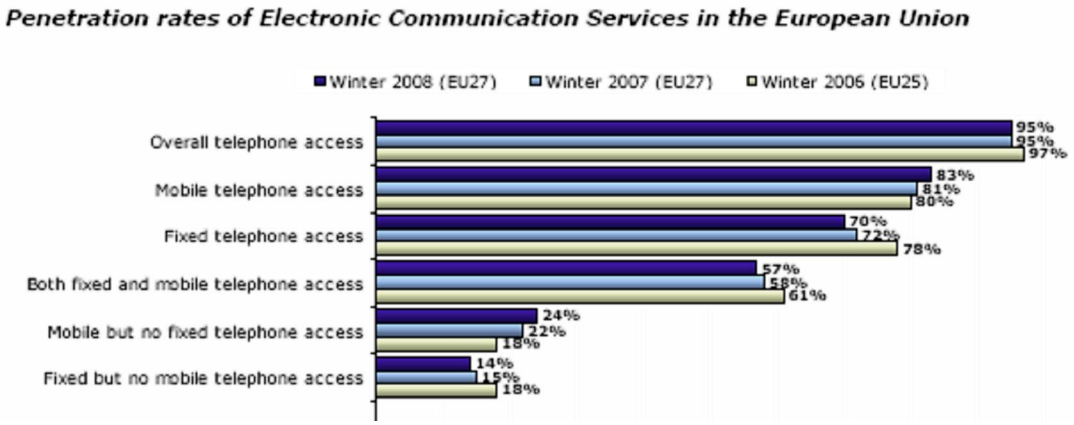
[3] E-Communications Household Survey, Special Eurobarometer 293 (June 2008). Available at: http://ec.europa.eu/public_opinion/archives/ebs/ebs_293_sum_en.pdf

Evolution of telephone and mobile access. Comparison 2007-2008 (EU/27)



Source: E-Communications Household Survey, Special Eurobarometer (June 2008)

The type of phone access varies greatly across the European Union: overall, both fixed and mobile telephone access are more widespread in the older Member States than in the newer Member States. Nevertheless, mobile telephony penetration rates are increasing more rapidly in the latter than in the former and mobile-only access proportions are significantly higher in the newer Member States (NMS12) than in the EU15.



Source: E-Communications Household Survey, Special Eurobarometer (June 2008)

Moreover, an increasing number of Europeans who have an internet connection at home declared in the same survey that a member of their household uses the PC for making phone calls over the

Internet (22%; +5 points since winter 2007). This proportion is more than twice as large in the new Member States.

The last Implementation Report[4] of the European Commissions (EC) states that following trends are identifiable in the European fixed line market:

- a decrease in traffic volumes,
- increasing fixed-to-mobile substitution,
- significant developments in VoIP services in some Member States
- and the emergence of bundled service offerings in most Member States

The report reminds NRAôs that remedies need to reflect as far as possible these trends.

A preliminary conclusion in the context of fixed-to-mobile substitution (FMS) might be that there is a trend of decrease in fixed telephony access and a parallel increase in mobile access, what means an important competitive factor for those operators who only provide fixed telephony.

Nevertheless, due to several reasons, but overall because of the higher price, we cannot conclude so quickly that an important part of the demand of fixed traffic will move to mobile.

SPANISH CASE

One of the most relevant criteria to understand the fixed-mobile substitution trend is price. In a theoretical field, we can establish a price as a limit/border for the substitutability between fixed and mobile. Further to this limit/border it is reasonable to consider that end users will sign up services like broadband or IPTV that are difficult to be substituted by a mobile operator.

In Spain 20% of the fixed lines have a monthly bill lower than the estimated limit/border (20ú). That means that roughly two million of lines could substitute its fixed access by a mobile access. But the evidence goes in the opposite direction, from 2006 (first market analyses) to 2008 (second market analyses) the amount of fixed **access** lines has raised up. This evolution would contradict the hypothetical trend of substitution of service fixed and mobile. Even when there is a phenomenon of increasing number of household with only mobile access (students, immigrants, etc.), at the moment it is hasty to conclude that mobile access service and fixed access service are substitute.

On the other hand, according to CMTôs data, the retail service of telephone **traffic** from a fixed line had a volume of incomes of ú 4.096,16 millions and a total traffic of 78.559,63 millions of minutes in 2.007. That means a decrease of 17,4% and 3,8% respectively in comparison to 2006.

CMT has identified as well a meaningful increase of mobile traffic and a gradual decrease in the volume of minutes over fixed lines. So it is that between 2005 and 2007 the volume of fixed traffic fell a 14,2% while in the same period the volume of mobile traffic increased a 40,8%.

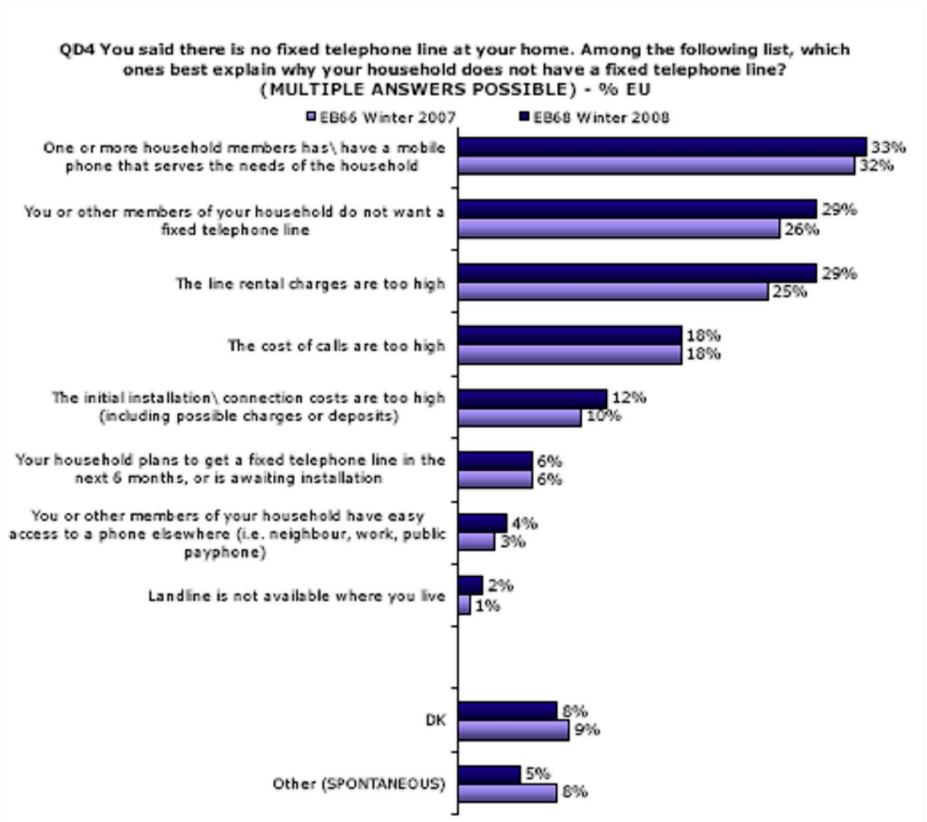
In the case of Spain it seems that this trend derives from the fact that voice is processed more and more over mobile networks or VoIP while fixed access keeps stable because

[4] Progress Report on the Single European Electronic Communications Market 2007 (13th Report). Available at: http://ec.europa.eu/information_society/policy/ecomm/library/communications_reports/annualreports/13th/index_en.htm

of broadband internet connection.

In the following graphic of the referred Eurobarometer survey (June 2008), we could appreciate several reasons for not having fixed telephone line at home.

Reasons for not having fixed telephone line at home



Source: E-Communications Household Survey, Special Eurobarometer (June 2008)

Along with the convergence of platforms, there is a clear trend towards bundled services, where operators offer a variety of services for a single global price often to the benefit of consumers. In this sense, end-users can benefit from fixed telephone and mobile access, IPTV and broadband internet connection through one operatorôs network.

The 13th Implementation Report refers to the Special Eurobarometer to mention the percentage of bundled packages in the European Union. Already 29% of Europeans say that their household buys two or more communication services as part of a bundle, which indicates that significantly more households now benefit from such services than in winter 2007 (increase of 9 percentage points and a total increase of 11 points since winter 2006).

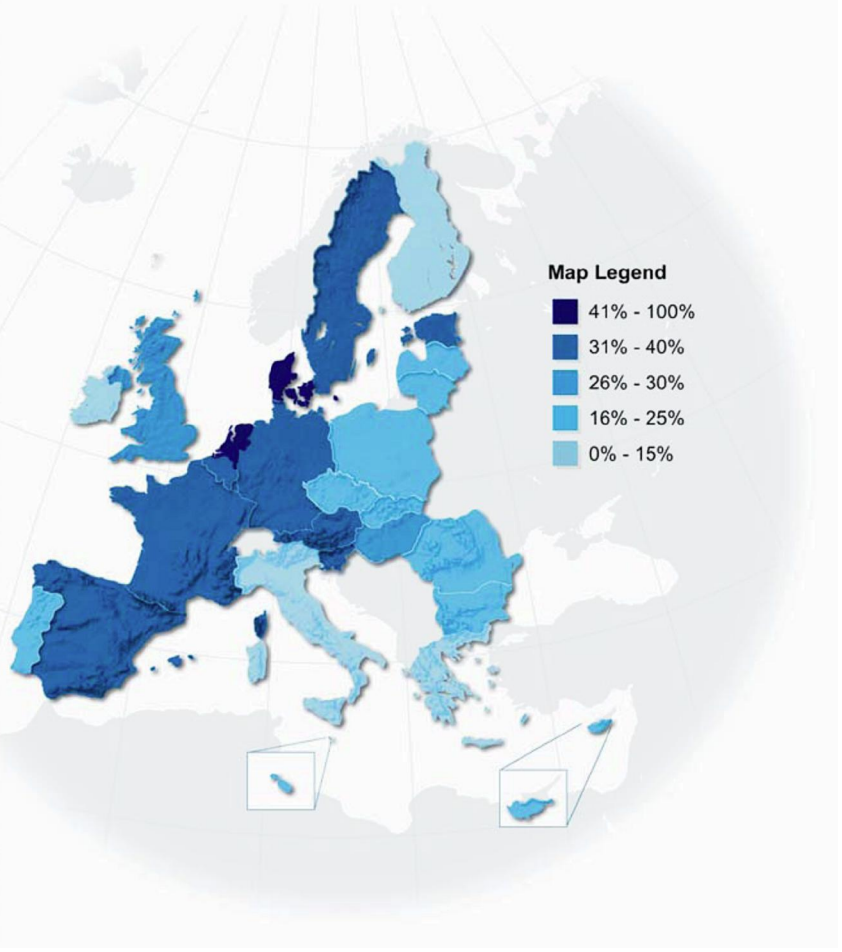
On the whole, communication bundles are bought most frequently in the older Member States of the EU, with the exception of Estonia (36%) and Slovenia (32%). On the other hand, households from the majority of the newer Member States tend to buy such bundles less frequently than Europeans on average.

Does your household buy two or more services as part of a bundle?

Question: QD14. By bundle, we mean a combined package offering more than one communication service from the same provider at a single price. Does your household buy two or more of the following services as part of a bundle?

Answers: Yes

Country Results	
Denmark	47%
The Netherlands	42%
Luxembourg	38%
Germany	36%
Estonia	36%
France	35%
Belgium	33%
Spain	32%
Sweden	32%
Slovenia	32%
Austria	31%
United Kingdom	30%
European Union (27)	29%
Hungary	27%
Portugal	25%
Romania	25%
Latvia	24%
Slovakia	23%
Lithuania	21%
Poland	20%
Cyprus	18%
Czech Republic	17%
Bulgaria	17%
Malta	16%
Ireland	15%
Italy	15%
Greece	12%
Finland	7%



Services: TV channels, fixed telephony, mobile telephony and internet access.

Source: E-Communications Household Survey, Special Eurobarometer (June 2008)

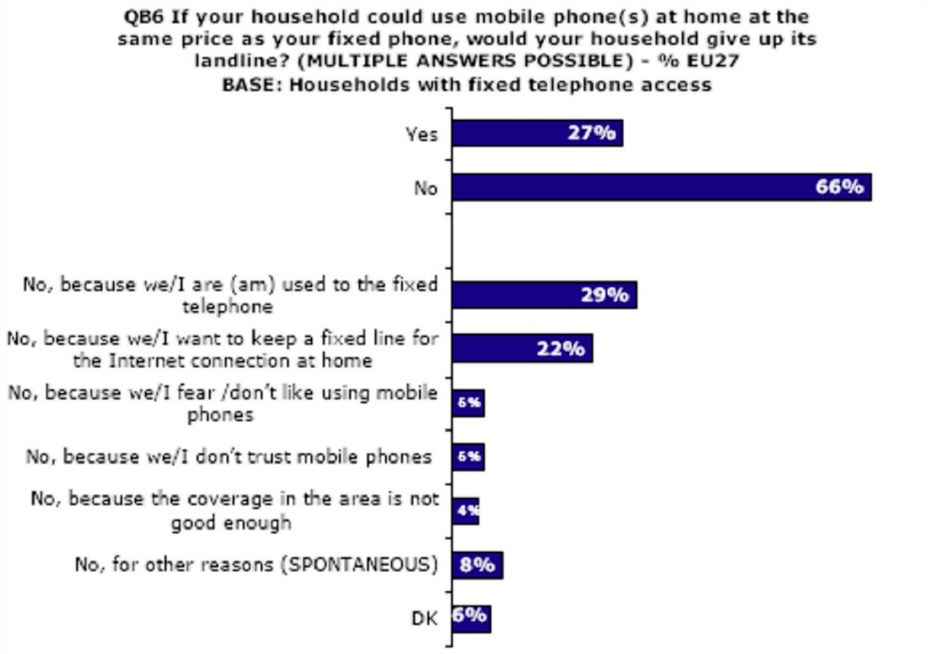
The study of substitution trends represents a real difficulty because of the complexity of the data gathering.

In two previous E-Communications Households Surveys[5] (but not in the last one) there was a chapter asking about substitution of fixed telephony access by mobile phone access. From the responses we could get an idea on substitution of fixed telephony traffic by mobile phone traffic.

In the example of the 2007 survey, Households with a fixed line were polled to analyse their price sensitivity to mobile substitution. They were asked if they would give up their landline if they could use a mobile phone at the same price as the fixed line for local and national calls.

[5] E-Communications Household Survey April 2007 and July 2006. Available at: http://ec.europa.eu/information_society/policy/ecomm/doc/library/ext_studies/household_06/eb07_finalreport_v4.pdf and http://ec.europa.eu/information_society/policy/ecomm/doc/info_centre/studies_ext_consult/ecomm_household_study/eb_jul06_main_report_en.pdf

Slightly over one in four households would give up their landline if mobile phone charges were at the same level. However, two-thirds of households would not switch to a ómobile-onlyô option even if this was the case.



Source: E-Communications Household Survey (April 2007)

Various reasons were given for the ófixed-line loyaltyô. Primarily, this appears to be linked to fixed lines being a matter of habit. 29% of the representatives of households say that they are used to the fixed telephone and would not therefore give it up even if it would be acceptable price-wise. Furthermore, for 22% of households the reason for keeping the fixed line is that it provides them with the internet connection.

Making an assessment of the graphic it could be said that in addition to the 27% of people ready to give up their landline and switch to mobile, a large part of the 22% that want to keep fixed line because of the internet connection would change to mobile telephony once the ERG-best practice on naked DSL is already implemented in European countries[6].

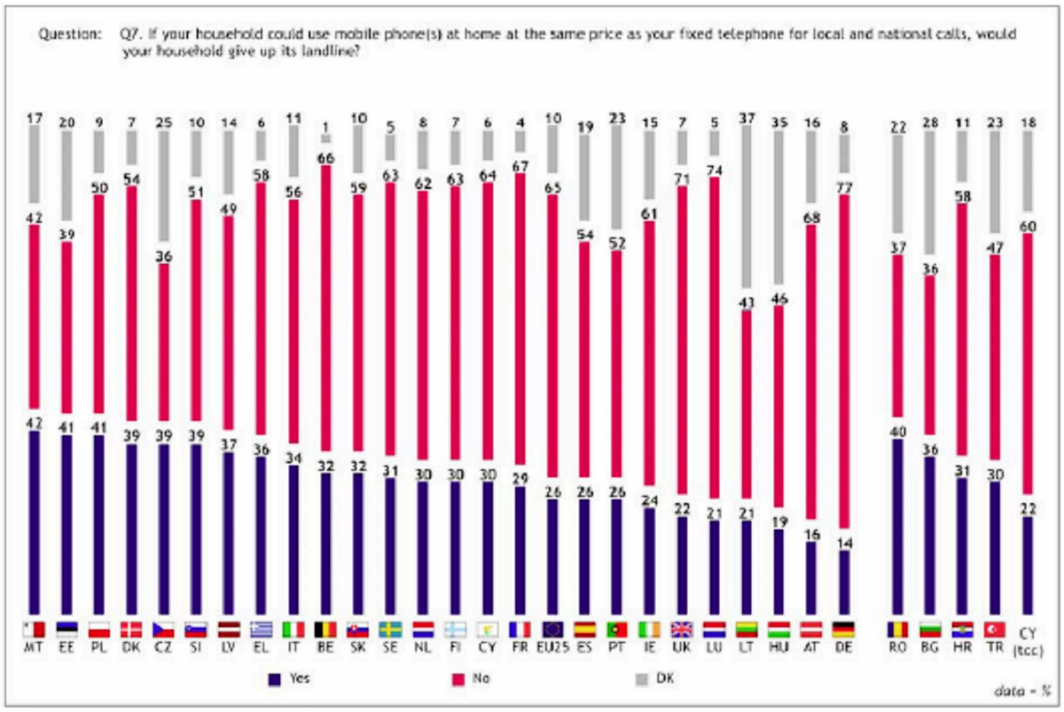
The 13th Implementation Report also considers that ñwhile mobile prices per minute are still at least double the price of fixed calls, and therefore come at a premium, mobile networks are catching up with fixed-line providers on price and speeds for broadband and, in some cases, prices are even lower than for fixed broadband. Such prices could encourage fixed to mobile broadband substitution and mobile-only households. This is also expected to put pressure of fixed broadband pricesò.

On the other hand, some 4% of people that keep fixed line due to coverage problems could also switch to mobile thanks to fixed-to-mobile convergent products (I.e. Femtocell solutions provide wide coverage and a good QoS).

[6] Best Practice 9 ñStand-alone bitstream access (St-WBA)ò from the Report on ERG best practices on regulatory regimes in wholesale unbundled access and bitstream access. ñIts best practice for NRAs to ensure that competitors are given the opportunity to request alternative access arrangements and that the SMP operator provides such alternative arrangements upon reasonable request. Where there is material commercial demand, it is best practice for NRAs to include St-WBA in the WBA reference offer. From the end-users standpoint, naked DSL should be as user friendly as PSTNò. Available at: http://www.erg.eu.int/doc/publications/erg_07_53_wla_wba_bp_final_080604.pdf

In this case the percentage of people ready to give up their landline and have mobile connection only would be considerably higher than it seems right now.

In the 2006 E-Communications Household survey, people were asked if they would give up their landline if they could use a mobile phone at the same price as the fixed line for local and national calls. Overall in Europe, one in four households would give up its landline if mobile phone charges were at the same level. In Malta, Estonia and Poland, as many as four in ten households would give up their fixed line.



Source: E-Communications Household Survey (July 2006)

The answer items on substitution trends were modified among 2007 and 2006 surveys. Consequently, the results of these two questions are not directly comparable. But in line with the trend observed in the winter 2007 survey, the use of mobile telephony has continued to increase in the EU27 while more and more households have given up their fixed line. Consequently, the share of ómobile-onlyô households is rising (24%; +2 points since winter 2007, +6 points since winter 2006), while the share of households with at least one fixed line has decreased (70%; -2 points since winter 2007, -8 points since winter 2006).

This trend must be seen in conjunction with an upsurge in wireless access to the Internet via the mobile telephone network or via satellite. This tend suggests that there is a new consumption pattern of electronic communications services emerging based on wireless technologies only.

SLOVENIAN CASE

The research agency Ninamedia has made a survey of the market for APEK, the Slovenian regulatory authority.

The research of the monthly household electronic communication services expenditures in September 2008 took place from October 9th to October 20th 2008.

The survey found that 34,6% of those interviewed had considered cancelling their fixed telephone connection because of the wide-spread use of mobile telephony. The majority of these were male, middle age, having a high school education, students and those with the highest income. They were all users of mobile phones.

In conclusion, substitution in the European countries is not subject to a clear trend so far, and additional research should be undertaken in order to gather additional data and consider many factors such as prices, culture, habits, QoS, telecom development in each EU-Country, percentage of bundled offers, etc. As a result, the initial conclusions could be refined further.

3 NRA views on competition issues

3.1 MVNO issues

As described in detail in Section 1, convergence suggests offering of mobile and fixed (or fixed-like) services seamlessly to the end-customer. In practice, convergence requires that mobile operators can provide fixed access, yet available via regulated unbundling and bitstream reference offer, and similarly fixed operator can provide mobile access through wholesale agreements with MNOs (such as Mobile Virtual Network Operator).

As briefly discussed earlier, each of the referred convergence architectures presented in section 1 are not accessible under the same conditions by every kind of operator:

1. Convergence with the handset: Can be provided by MNO by using unbundling or bitstream and by FNO either as ESP (but routing is under control of the wholesale MNO, when using mobile numbering for incoming calls) or as full MVNO.
2. Femtocell: Only provided by MNO.
3. Fixed like rate: Can be provided by MNO without any fixed access and by full MVNO (to be able to localize users for billing purposes); it does make sense for FNO only if it is also MNO.
4. VoIP on mobile broadband connection: Can be provided by FNO as any type of MVNO with data services; it does not make sense for MNO.

The purpose of this section is to present any issues that NRAs have identified as regards the availability of wholesale agreements from MNO in terms of features, cost and time to market that would allow operators to provide any type of convergent services.

In this context, as also indicated above, both voice and mobile broadband wholesale agreements from the MNOs are considered since they allow different types of convergent services to be implemented. It is important to note that if wholesale agreement from MNOs is not available then operators are not in position to offer all types of convergent services. For example, if a wholesale agreement is not in place then the operator will not be able to provide seamless access to the GSM network from UMA handset as described in point 1 above. In this context, possible regulatory obligations already imposed on market 15 are also examined.

3.1.1 MVNO Services

The first questionnaireôs enquiry referred to the availability of MVNO services in each country, as those are described in detail in the paragraph above. In total, 18 countries answered to this question. In total, 6 countries have answered that no types of MVNOs are available so far. Only in 4 countries there are/have been full MVNOs. In 13 countries there are SP-MVNOs and/or ESP-MVNOs.

It is therefore concluded that the main type of MVNOs that are prevailing throughout these 18 countries are SP-MVNOs and/or ESP-MVNOs.

3.1.2 MNO wholesale offers

The second question requested from the NRAs to submit data on the availability of wholesale offers to fixed operators with the appropriate level of functionalities so that they are in position to offer

FMC services. Also, the second question requested from the NRAs to indicate whether they consider that ex-ant regulation is required so that such offers are made available.

In total, 18 countries answered to the second question.

Currently, there is ex-ante regulation in force where operators are obliged to meet agreements under reasonable terms only in two countries (Spain and Slovenia). As an example, in one of these countries (Spain), this regulation has permitted a number of MVNOs to start the provision of services (9 MVNOs, 9 SP-MVNOs).

From the answers received, in two countries (Romania and Italy) there is currently ongoing review and public consultation correspondingly for the access and call origination market. It should be noted that in one of these countries (Italy) although the Full-MVNO model is in its initial stage, main fixed operators are, or will be soon ESP in the mobile market.

Three countries (Greece, UK and Estonia) indicated that in the latest review round of Market 15 it was concluded that no MNO has significant market power and as a consequence there is currently no ex-ante regulation requiring MNOs to provide wholesale access. Also another country (Hungary) indicated that it has not imposed any ex-ante regulation.

Several countries (Estonia, Finland, Austria and Poland) indicated that in general fixed operators should be able to obtain wholesale service offers (under commercial terms and negotiations) with the appropriate level of features. In particular, one of these countries (Austria) indicated that wholesale mobile broadband access product is available from at least one MNO. One country (Portugal) indicated that it believes that fixed operators might be able to negotiate and possibly obtain a wholesale offer with the appropriate level of features. However, this country also indicated that this does not restrain the regulator from analysing Market 15 if such analysis should prove itself necessary.

Two countries (Romania and Denmark) indicated that they do not hold any evidence with regards to fixed operatorsô demand of such services.

Finally, three countries (Belgium, Czech Republic and France) indicated that it seems that there are difficulties for fixed operators to obtain wholesale agreements (e.g. MVNO) with the appropriate level of features and thus ex-ante regulation seems to be required. Particularly, one of these countries (France) indicated that European Commissions raised objections with regards to its 2005 joint dominance finding on M15 analysis. In addition, that country (France) indicated that MVNOs have virtually no technical autonomy since MNOs strongly control access conditions to their networks via contract clauses. Also, another country (Hungary) indicated that so far no wholesale offer has been provided by any MNOs to any MVNO challengers.

Finally, one country (Switzerland) indicated that there is no official position regarding this question.

Summarizing, in the majority of the countries (16 out of 18), based on the answers received and on the data available from Cullen Market Database[7], there is no ex-ante regulation imposed related to access and call origination on mobile networks (M15). Only 3 out of the 18 countries clearly indicated that fixed operators may face difficulties so as to obtain wholesale agreements with the appropriate level of features.

In general, with regards to the second part of the question it should be noted that no strong statements were made indicating that ex-ante regulation is required so as to ensure that wholesale agreements with MNOs can be achieved

[7] Cullen Market Analysis Database-M15 access and call origination on public mobile telephone networks.

3.1.3 Mobile bitstream access

The next question requested from the NRAs to submit data on the availability of a kind of mobile bitstream access from MNOs.

In total 17 countries answered to the third question. In general, no specific statements were made with regards to the availability of a ñbitstreamò service from MNOs. Several countries indicated that access to a ñbitstreamò service on a mobile network would be the result of commercial negotiations. One country (Belgium) indicated that there has been MVNO contract from MNO including mobile data but it seems probably insufficient so as to allow offering full IP service.

Also, two countries (Austria and Estonia) indicated that certain MNOs have provided wholesale mobile data access products. One of these countries (Austria) indicated that regarding VoIP over mobile broadband speech quality aspects must be considered, especially packet delay times which are critical for QoS. In addition, another country (Spain) indicated that current regulatory remedies (M15) contemplate the possibility to reach access agreements with MNOs including the provision of data services.

3.1.4 Competition distortion

The purpose of this question was to evaluate whether the different status between unbundling/bitstream offers on fixed networks and MVNO offers on mobile networks may distort competition between fixed and mobile operators.

In total 18 countries answered to this question. Two Countries (Czech Republic and Hungary) indicated that this has not been yet considered. Other two countries (Turkey and UK) did not provide an answer on this question.

In total 2 countries (Poland and Switzerland) stated the actual market structure should not cause any competition disorder between fixed and mobile operators. Several countries (Romania, Denmark, Italy, Greece and Estonia) indicated that any related issue will be addressed when identified. Also, one country (Finland) indicated that the issue is practically solved on a commercial basis.

Then several other countries (Belgium, Portugal and France) indicated that fixed network operators are disadvantaged against mobile network operators to be able to provide convergent products since it seems difficult to achieve agreements where features cost and time to market requirements can be met.

Also, these countries indicated the very different levels of mobile and fixed termination rates should be considered as another possible source of distortion. Finally, one country (Spain) indicated that before the imposition of remedies in Market 15 there has been a clear entry barrier to fixed operators.

3.1.5 Market definition

The purpose of the question was to indicate whether FMC calls should be included in Market 3 or Market 7.

In total fifteen countries answered to this question. Three countries (Turkey, Denmark and Hungary) indicated that this has not been yet analyzed.

Several countries (Poland, Romania, Estonia and Greece) indicated that depending on the functionality of the FMC services it is possible that these should be treated within the context of

Market 3 or Market 7. In addition, three countries (Poland, Romania and Italy) indicated that FMC services provided at fixed locations should be regulated on Market 3.

Two countries (Finland and Spain) indicated that FMC services could be more related to Market 7 than Market 3.

Other countries (France, Spain, Portugal and Czech Republic) indicated that market definition is currently based on the receiverôs number rather than the technology used. Six countries (Czech Republic, Spain, Portugal, Estonia, Belgium and Greece) indicated that due to market dynamics the approach towards termination markets might evolve. In particular, one country (Belgium) indicated that it should be considered whether these two markets should merge in a single market and an average termination rate should be defined.

Also two countries (Italy and France) indicated that the definitions of the termination markets do not need further adjustment for the moment. In particular, one country (France) indicated that the definitions of the termination markets do not need further adjustment for the moment although the need for increased coherence between fixed and mobile termination rates regulation need to be taken into account.

3.1.6 Regulatory implications

The key findings from the questionnaire with respect to competition issues can be summarized as follows:

1) It appears that SP and ESP MVNOs are the most widespread types of MNVOs available. Full MVNOs are/have been available in four countries only. In several countries there are no MVNOs available so far.

2) With regards to the availability of MVNO offers from MNOs, all possible cases can be observed. Three countries indicated that there are difficulties to achieve MVNO offers. Also six countries indicated that such offers should be available (mainly based on commercial agreements with the exception of CMT where ex-ante regulation is enforced). Finally, two countries indicated that so far they hold no evidence of fixed operatorsô demand of such services.

3) With regards to the availability of a kind of ñbitstreamò service from MNOs towards MVNOs, there were three countries that mentioned that such an offer is currently available although technical issues especially regarding mobile VoIP were remarked.

4) Three countries indicated that fixed operators are disadvantaged against mobile network operators in offering fixed mobile convergent products since the MVNO agreements do not necessarily meet requirements for features, cost and time to market. At this point, specific characteristics of wholesale agreements were indicated such as access to technical elements, interconnection services, billing, localization etc. Also with regards to wholesale mobile broadband agreements specific features were indicated such as VoIP speech quality aspects since packet delay times are critical for QoS. Four countries indicated that the issue of competition distortion between fixed and mobile operators will be addressed when identified. Also, three countries indicated that the current market structure should not cause any competition disorder between fixed and mobile operators. Finally, three countries highlighted the fact that asymmetry between mobile and fixed termination rates can raise issues and should be investigated as potential source of distortion as fixed mobile convergence services become widely adopted.

At this point ñfixed-like rateò services were noted as an example where due to the lower fixed termination rates MNOs are able to offer nearly unlimited calls towards fixed numbers when the user stays at home. Besides, FMC products tend to increase other customersô bill when using mobile numbers for incoming calls, despite the fact that more efficient FMC technologies (for example UMA) enable to decrease the costs of the terminating operator for calls to the home. Moreover, in such cases, mobile operators offering these FMC products benefit from high mobile termination rates

5) In general, six countries indicated that looking forward the definition of termination markets may have to be evolved according to the technology used and not the numbering (receiverôs number).

Concluding, although in most answers there were no specific regulatory concerns raised, the following regulatory challenges could be highlighted:

1) Wholesale agreements (i.e. MVNO) from MNOs: whether those meet the requirements in terms of functionalities, cost and time to market that would allow operators to offer any of type of convergent services without limitations.

2) Evolution of the definition of markets 3 and 7 as FMC services become widely adopted i.e. whether FMC services should be treated in the context of Market 3 or 7.

3) Issues that the current asymmetry in fixed vs. mobile termination rates can raise as FMC services become widely adopted.

3.2 Mobile VoIP

In its earlier released documents on VoIP[8] related issues ERG stated that VoIP services are becoming more common as electronic communications services are shifting to IP-based networks. VoIP based Telephony services, that is when identified as Public Electronic Communications services, could be the future telephony service replacing traditional PSTN telephony services one day.

The phenomenon of fixed-mobile convergence is enhanced by the technological advancements in core and access networks. The new network capabilities are one of the enablers to offer convergent multimedia services built upon the NGNs, which are shared core networks for all types of access and services and packet mode transport.

Also the price decrease of VoIP network termination equipment has enabled operators and service providers to bring about complex, low-cost services such as femtocells, mobile over broadband or VoIP over Wi-Fi or VoIP over 3G.

3.2.1 Product definition

Usually the VoIP-based service alterations are named after the underlying transport technology the given service uses, like VoIP over broadband (VoB) or VoIP over mobile (VoWLAN, Vo3G, VoWimax), etc. Users may access through ADSL, cable modem, Wi-Fi, WLAN, 3G or other broadband IP connections across a variety of VoIP terminals. These include IP-phones, soft phones

[8] http://www.erg.eu.int/doc/publications/consult_draft_cp_voip/erg_07_56_rev1_voip_draft_cp.pdf

running on PC or PDA, Smart mobile-phones, POTS/DECT with ATA or Dual Mode (GSM+WLAN) mobile phones.

To clarify matters, ERG took a step forward with its ñCommon Position on VoIPò and the corresponding consultation in late 2007. The CP classified potential VoIP products in 4 categories, regardless of the transport technologies or customer segments, only from the accessibility point of view. This classification allowed to set-up a clear distinction between telephony services that may require some regulation and other services that are out of scope of current regulation.

Since the introduction of the ERG categorisation (see Section 1, ERG Common Position on VoIP), VoIP over mobile broadband access has emerged, as stand-alone applications are being offered for mobile telephones by independent software companies, that specialise themselves to provide network-independent mobile applications, that are capable to use multiple VoIP standards, even those that fit into ERGôs telephony service classification. As a telling example of the operator-independent VoIP capability, it is enough to note that from 2007, Nokia has been regularly implementing SIP-VoIP capability into their mobile phones. Another example when operators closely cooperate with software companies and provide managed services comes from Austria, where MNO Hutchison provides a service based on a cooperation with Skype (costs EUR 4.-/month, unlimited minutes from Hutchison phone to Hutchison phone or to external Skype terminal; (currently supported on a number of Nokia and SonyEricsson phones). This service has also been offered in Italy by Hutchinson 3G, and even if the set of tariffs is done by measuring ñVoIPò traffic-usage, it is important to note that at this point the underlying technology is rumoured to be circuit switched-to-the VoIP gateway rather than truly end-to-end VoIP over 3G. Threeôs retail Skype offering is also available in the UK, and there are several other operators that are reported to start implementing VoIP services there.

3.2.2 Current implementation of mobile VoIP services by MNO

According to the questionnaire responses, MNOs are not commercially interested in pushing the deployment of end-to-end VoIP services, but for example in Spain, MoviStar Emocion, Vodafone Live and Orange have reached an agreement with MSN and other messaging platforms and include it within its data service offer, obviously using its UMTS or GPRS data networks.

In Hungary, despite that there are no MVNOs or wholesale MNO offers yet available, handset-manufacturer Nokia teamed up with independent ISP ñMacrogateò, to provide SIP gateway functionality for their phones, providing cheap prepaid VoIP over 3G and Wi-Fi.

As MNOs provide dual-handsets, Universal Mobile Access (UMA) services can be offered by MNOs over Wi-Fi hotspots or femtocells connected over fixed broadband connections. As an illustration, Unik is a Universal Mobile Access type service available in France. As an add-on to existing subscription, this option contains unlimited calls to fixed lines in France and a group of foreign countries for a fixed rate per month. Calls to mobiles are charged on the userôs mobile subscription invoice whether they use Wi-Fi or GSM/UMTS (minutes cap per month + additional rate per minute over the cap). Unik also has an option with unlimited on-net mobile calls from a Wi-Fi connection for a fixed rate per month.

3.2.3 VoIP traffic discrimination

As, in this case mobile broadband connections constitute the transport layer, the questionnaire has inquired about how VoIP traffic is usually charged by the MNOs offering the mobile broadband connections - e.g. flat fee with a volume cap or by differentiated charging (price discrimination on the data traffic by protocol-type, destination, domain etc).

Normally there is no discrimination, and flat-rate broadband tariff packages are generally limited by a normal usage-cap or fair-usage policy. In some countries, like in Portugal, the MNO may block the usage of VoIP protocol via mobile broadband access. This is also the case in Spain, where Vodafone, MoviStar, Orange do not allow in some of their tariffs VoIP and P2P traffic through their broadband connections while others (Yoigo, Simyo) do not block such traffic. These artificial barriers are rare yet, and in most countries there is no tariff-discrimination for VoIP traffic over mobile networks, or any traffic-limitations in the usage of VoIP services, but this maybe only because in most countries VoIP over mobile has not yet posed a real threat to MNOs.

As a positive example, charging is non-discriminative in France, which is one of the most developed VoIP user countries. There usually, VoIP traffic charges by the MNOs use the same pricing principles as VoIP over fixed broadband access (for instance unlimited national and local calls). There the most popular wireless VoIP public offers are called Twin9 and Freephonie. Although not a true mobile VoIP service as far as coverage is concerned as it uses a Wi-Fi connection (from home set top box or hotspot), Freephonie is also based on SIP. ñFreeò charge their users with the same rates as in their ñtriple playò bundle: unlimited calls to fixed lines in France and a group of foreign countries for a fixed rate per month; and prices discriminated on the destination operator for calls to mobiles (fixed rate for each call + rate per minute).

3.2.4 Substitution aspects

The question whether there is an intention from NRAs to treat VoIP as data services was overwhelmingly rejected by most of the NRA. Only a few countries do not regulate VoIP at all, and when it comes to managed VoIP services then more that 70% of all respondents categorised VoIP as voice services, and only in Poland did the regulator consider VoIP as data service.

Rather unanimous answers were provided by NRA regarding to the question whether local regulators believe that mobile VoIP (unmanaged or managed) could become a substitute for the call termination service. Most regulators think that this market is still very young and underdeveloped. However, with services increasingly shifting to the data domain this may become an issue in the medium to long term and may be addressed accordingly in a future market analyses. There is also unanimous agreement that unmanaged mobile VoIP is not a substitute for mobile calls, some (France) even mentions the barriers that may prevent this service ever becoming a substitute: ñMNOs often set technical barriers (by blocking protocols on the network or applications on handsets), which are a problem for most usersò and ñQuality of Service is really bad for unmanaged VoIP calls.ò

Therefore the conclusion to this aspect is that even if cable VoIP is strongly substituting traditional PSTN subscriptions in countries with advanced cable TV networks, VoIP in Europe is still primarily used as an add-on to ADSL, and not as an add-on to 3G mobile broadband. Yet, the increasing availability of naked DSL may make VoIP a viable alternative to PSTN, and if there were naked mobile broadband offers available to MVNOs then VoIP could become an alternative to GSM. In fact, in Austria for example there are also wholesale products of MNOs for mobile SP, not only voice but also for data, and specially there is a wholesale product for mobile broadband access available from at least one MNO. Similarly, in Finland AinaCom Oy (ESP-MVNO) also offers mobile broadband connections, but mobile VoIP is not yet mentioned in these countries.

[9] The Twin service has been stopped since the questionnaire was received

3.2.5 Regulatory implications

The ERG CP of late 2007 stated that different regulation across EU Member States has been justified in the beginning of VoIP diffusion. But with the further development, harmonized approaches are gaining importance and are necessary to ease the implementation of pan-European strategies and cross-border investment. The market and the consumers require ERG to introduce a common framework that ensures services available to consumers as a right regardless of the technology and the platform over which they are delivered.

The ERG common position also declared that there are many IP based voice services/applications usually offered via the Internet (call back services, click to dial, real-time chat services, voice blogging and so on) that do not fall within the categories 1-4 of the CP. Even though these services may be generated by voice over IP in a literal meaning, they are clearly no telephony services in a traditional understanding and in respect to the above mentioned definition as they do not allow any to any communication by originating and/or receiving national and international calls by using a number or numbers in a national or international numbering plan. These services should not be subject to regulation of telephony services.

Mobile VoIP (e.g. over 3G) is not in the same situation, and can be included within the referred ERG categorization. It must be noted that VoIP supplier cannot detect whether users are accessing the service through fixed or mobile networks since they are using their mobile internet subscription. By now convergence has evolved to a level when besides the ñtraditionalò FMC players of MNOs, MVNOs and FNOs, others, like independent software companies, handset manufacturers have become willing and able to provide complex ï telephony services, without owning any element of the access and transport infrastructure itself. The cheap consumer prices of broadband services of fixed and mobile networks enable these so-called ñSoftcoò-s to build VoIP based services solely providing software applications that run on handsets (VoIP over the Internet) over 3G and other wireless networks and are perfectly compliant with E.164 numbering and are fit with the outgoing and incoming number tests as well.

It may be true that speech quality aspects are sometimes still to be considered; as especially packet delay times are critical for QoS, but significant improvement will arrive with the availability of future 4G systems. It may also be true that if the mobile VoIP service is provided by an operator without cooperating with the MNO then there is the problem of one stop billing. The drawback of current mobile VoIP solutions is that it is usually the end-user that subscribes to the mobile operator for a mobile broadband connection, thus the alternative operator cannot provide one stop billing, but wholesale broadband offers are emerging and that solves this problem.

In its paper on VoIP ERG defined the major regulatory concerns regarding:

1. Access to emergency services
2. Nomadic use
3. Number portability
4. Consumer rights
5. Network integrity

AS regards mobile VoIP, ñNumbering and number portabilityò and ñNetwork neutrality issues ï traffic blockingò might add to the list.

ñNetwork neutralityò is normally not an issue in FMC products, since in such case a single provider offers fixed and mobile access and he does not use a third party retail service (ñnetwork neutralityò is by nature inherent to wholesale services). However, some scenarios are emerging based on the

provision of FMC services through third party retail access. Such service providers provide convergent devices to end-users that access the services by using the broadband access they have contracted with a third operator. No wholesale agreements exist in this case, so this scenario may raise in the near future the necessity to deal with network neutrality issues. Similar issues may occur when the VoIP service provider cannot obtain a wholesale service permitting him to build an offer including mobile access, and thus must provide the VoIP service using the retail service that the end-user is provided by the MNO.

Thus, network neutrality -blocking becomes immediately an issue as mobile VoIP gains popularity, which is likely in the mid-term, as VoIP applications will be put on portable devices, and smart-phones, like the Apple iPhone. These services are provided not on the transport, but on the application layer without the ñproperò knowledge and the definite counter-interest of the access service providers. On average, a VoIP application uses between 3-16 kilobytes/sec, thus the current usage-cap of a 5 GB broadband package already offer quasi unlimited talk-time. The possible defending strategies of mobile network operators are that they are really capable of undermining quality by obstructing/blocking independent VoIP providers.

Conclusions

This report intends to provide preliminary guidance on the different implications of fixed to mobile convergent products. Currently available convergent products have been described and an overview of the current regulatory situation in the European countries has been provided.

The paper goes one step further into a preliminary study of the commercial and regulatory consequences of convergence, which represents a critical phenomenon because of the key implications it has in the telecom sector.

Some initial conclusions have been reached, and are summarized below:

As assessed in the paper, in principle there could be some relevant differences between the difficulties that mobile and fixed operators face in entering on the FMC market. Mobile operators have access to regulated offers, mainly cost oriented, with some enhancements being considered by some NRAs to include functionalities such as QoS functionalities in bitstream offers. Fixed operators have only access to commercial wholesale offers from mobile operators, which they could in principle refuse to provide them or could propose high prices, thus blocking the entrance of new competitors in the FMC market.

However, the majority of the NRAs that contributed to this paper remarked that there is no ex-ante regulation imposed in the access and call origination on mobile networks (M15). In general, NRAs have not clearly stated that ex-ante regulation is required so as to ensure that wholesale agreements with MNOs can be achieved; particularly, only a few NRAs clearly indicated that fixed operators may face difficulties so as to obtain wholesale agreements with the appropriate level of functionalities.

As a consequence, only few NRAs indicated that fixed operators are disadvantaged against mobile network operators in offering fixed mobile convergent products since the MVNO agreements do not necessarily meet requirements for functionalities, cost and time to market. These NRAs pointed out the fact that apparent asymmetry between mobile and fixed termination rates can lead to differentiated margins and affect profitability, and thus should be investigated as fixed mobile convergent services become more widely adopted. For example, ñfixed-like rateò services provided by MNO are possible due to the lower fixed termination rates that MNOs have to pay, which facilitates that they can offer nearly unlimited calls towards fixed numbers when the user is located at home.

Several countries suggested that moving forward the definition of termination markets may need to evolve according to the technology used and not the number called (receiverôs number).

With respect mobile VoIP, ñNumbering and number portabilityò and ñNetwork neutrality issues ï traffic blockingò might add to the list of issues identified by ERG in its paper about VoIP.

ñNetwork neutralityò is normally not an issue in FMC products, since in such case a single provider offers fixed and mobile access and he does not use a third party retail service (ñnetwork neutralityò is by nature inherent to wholesale services). However, some scenarios are emerging based on the provision of FMC services through third party retail access. Such service providers provide convergent devices to end-users that access the services by using the broadband access they have contracted with a third operator. No wholesale agreements exist in this case, so this scenario may raise network neutrality issues in the near future.

Network neutrality-blocking becomes immediately an issue as mobile VoIP gains popularity, which is likely in the mid-term, as VoIP applications will be put on portable devices, and smart-phones. These services are provided not on the transport, but on the application layer without the knowledge or control of the access service providers.

Annex 1. Case study: Building FMC products

This section examines how mobile and fixed operators can provide convergent voice services, being strictly limited to voice services and thus not taking into account the eventual requirement of end users to have a single provider for data and voice services.

As shown in section 2, two scenarios can be identified with respect end-users behaviour:

- End-users with a mobile subscription only. This demand will increase with availability of naked broadband and extension of mobile network coverage with FMC products.
- End-users that intend to keep the fixed telephony service at home, because they are not willing to use their mobile handset at home; in such case the FMC products they may require must permit to use the wired handset at home, so the network must avoid routing calls to the mobile device.

In the first scenario end-users are pleased to use exclusively a mobile subscription if the prices for calls generated at home are equivalent to those that apply to fixed subscriptions. These users require a single number and a single handset, and in principle may be not concerned about the technical implementation or the price paid by calling parties in incoming calls.

In both cases similar constraints are faced by operators that intent to provide FMC services, as addressed in the following lines.

1 Mobile operators service provision

Home zone based services can answer to this demand. However, in case of high success, the capacity of the mobile network may become insufficient. A simple way to extend it is to use home cells (femtocells), that have the advantage to be fully integrated to the mobile infrastructure, or a Wi-Fi/ or DECT home equipment that have the advantage to be largely available but the disadvantage to require dual mode handsets and usage of two technologies (VoIP and GSM/UMTS).

Nevertheless, when the customer does not have a broadband connection, home zone solutions exclusively based on mobile access are the only possible solutions to offer FMC products.

1.1 Wholesale products needed by mobile operators

Mobile operators require a broadband link to connect femtocell or VoIP CPE (Customer Premise Equipment). Depending of the requirements, it must be a best effort or QoS broadband connection.

When a best effort connection is sufficient, operators can use existing unbundling, bitstream or broadband resale offers, or even pass through the existing naked broadband service subscribed by the end-user with another operator. All these possibilities are available around Europe.

When QoS is required, operators can use unbundling offers, or bitstream offers that include QoS functionalities. However a bundle with broadband access must be offered to the user because there is no offer to get PVC from a broadband line operated by another provider.

Wholesale offers that could be required when QoS is necessary:

- Bitstream with QoS when not available, as recommended by ERG[10].

[10] ERG (07) 16 Rev 2 ERG Opinion on Regulatory Principles of Next Generation Access

- Sharing of broadband access (PVC on a broadband line operated by another entity); it is particularly requested when the end-user wishes to get a DSL broadcast offer that is not provided by the mobile operator.

2 Fixed operators service provision

Fixed operators can perform as any type of MVNO. However, the service provider option is less satisfactory because the related traffic is not routed though his own network, thus reducing the return of this infrastructure; therefore they do not have the same level of control on their costs and they do not have terminating revenues, thus positioning such entities in a more difficult situation from a competitive perspective.

Options such as Full MVNO or ESP MVNO with usage of VoIP fixed service are more attractive to fixed operators. It must be noted that such operators have mobile numbering, and thus receive mobile termination rates.

A less costly solution for fixed operators ï taking into account that VoIP could replace PSTN/ISDN after completion of NGN migration ï is that consumer uses a mobile data access to enable VoIP on the handset. The advantage is to avoid investments in GSM/UMTS platforms, but the drawback is that VoIP services are only related to the fixed telephony service, so the operator can only receive fixed termination rates, and not mobile ones, maybe resulting in insufficient revenues to cover the costs of the mobile data access.

2.1 Wholesale products needed by fixed operators

Fixed operators must become full MVNO or ESP; these alternatives may not be available in all countries (see section 3) because mobile operators can refuse to provide such service or provide it at excessive costs.

Wholesale offers that could be required:

- Full MVNO, ESP or DSP at reasonable cost.

Regulatory challenge

- Attribution of mobile numbers for VoIP operators providing FMC products with number portability.
- Localization of end-user must be provided to DSP and mobile bitstream beneficiaries to permit them to give access to emergency services.

3 Regulatory implications

FMC products are not fully efficient due to the need to keep the fixed number to permit calling parties to pay less, and the uncertainty about which number is given by the operator as calling number in outgoing calls.

FMC products can also increase the customerôs bill because the usage of mobile numbers will be increased when calling people at home, despite the fact that FMC can decrease the costs of the terminating operator.

These two drawbacks are founded on the relatively higher terminating rates of mobile calls. The possibility to have similar terminating rates for all networks could reduce this and may also help with the following:

- numbering issues (no need to have distinction between the type of service, a single personal number can be provided),
- risk of bill increasing,
- potential discrimination of VoIP providers, who can not be assigned mobile numbering and can not receive mobile termination rates. Thus, there is a high probability that their termination revenue does not cover wholesale costs for mobile access, and as a consequence they must receive more revenue from their own customers by means of higher retail prices.

In principle there could be some relevant differences between the facilities that mobile and fixed operators enjoy by entering on the FMC market. On one hand mobile operators have access to regulated offers, mainly cost-oriented, with some enhancements being considered by some NRAs to include functionalities as described in previous paragraphs. Fixed operators have only access to commercial wholesale offers from mobile operators that could in principle refuse to provide them or could propose high prices thus blocking the entrance of new competitors in the FMC market.

Finally, if FMC becomes the standard voice component of triple play, and triple play demonstrates to be a key demand of customers, there could be a risk that the absence of broadcast features in bitstream and the cost of access to content give a high competitive advantage at fully vertically integrated operators operating both fixed and mobile services.

Annex 2. FMC questionnaire

1. DEFINITIONS/DESCRIPTIONS

Convergence implies to offer mobile and fixed (or fixed-like) services seamlessly to the customer. It requires that mobile operators can provide fixed access, yet available via regulated unbundling and bitstream) ant that fix operator can provide mobile access by using commercial offers ***Mobile Virtual Operator (MVO)****. These offers can be classed in 4 categories described hereafter, for each it is possible to include or not data services in the agreement:*

Full MVNO (or simply MVNO- Mobile Virtual Network Operator)**:** The MVNO owns the same processes and platforms as the **MNO** (Mobile Network Operator), with the exception of the Access Network (radiofrequency base stations, base station controller) because the MNO does not have a license relative to radio frequency spectrum utilization. As a consequence, in order to provide the same MNO services, the MVNO must utilize the MNO access Network. It is important to note that the Full MVNO manages the switching, the transport and the termination of calls, including the localization of users, and, by owning a telephone number range, provides the SIM to the final users.

SP-MVNO (Service Provider): the service provider only provides by his own platforms and processes services like billing, marketing or sales and uses the entire MNO network to provide the telecom service.

ESP-MVNO (Enhanced Service Provider): the enhanced service provider has the same characteristics of the previous model except for the fact that it has some telecommunications platforms like his own HLR, SMSC or MMSC. These platforms allow ESP to have a higher freedom level from MNO than a SP.

<u>These different types of MVO services do not permit to provide the same level of functionalities to a convergent operator:</u>

In all cases the MVO can not offer its services (full mobility, in particular during riding) without accessing the MNO Access/Infrastructure Network. But, if the MVO is a Fixed Network Operator (or broadband operator) then it can utilize its Fixed access Network linked to Wi-Fi (or WiMax) and can offer a wireless access (limited in terms of mobility) to its clients through UMA (Unlicensed Mobile access).

Convergent Full-.MVNO: In this case the convergent Full-MVNO is also a Full MVNO and can exploit all the roaming feature of the MHO Network. Hence, if the user is in roaming under the MHO Network (and not in the Wi-Fi coverage area) it is routed through the MHO Network. Vice versa, if the user is in the Wi-Fi coverage area the call remains inside the Full MVNO convergent Network.

<u>The following types of architures can be implemented by a convergent operator:</u>

1. Convergence within the handset, the end-user uses a mobile 2G or 3G handset that is connected to domestic Wi-Fi or DECT network at home; the network can recognize if the handset is on the mobile or the fixed network.
2. Same as (1) but with the possibility not to use 2G or 3G handset at home.

3. Installation of a femtocell at the end-userôs home that is connected to the network via broadband access and subject to a fixed-like tariff scheme when the user remains at home.
4. Offer of a fixed-like rate when the end-user is connected via a cell defined as the ñhome cellò.
5. VoIP on a mobile broadband internet connection; in this case there is no usage of mobile numbers and the VoIP provider ignores whether the call is routed via fixed or mobile networks.

Each of the referred architectures is not accessible under the same conditions by every kind of operator:

Architecture 1. Can be provided by MNO by using unbundling or bitstream with QoS and by FNO taking ESP MVNO (but routing is under control of the wholesale MNO) or full MVNO.

Architecture 2. Can be provided by MNO taking unbundling or bitstream with QoS and by FNO taking full MVNO (to be able to route calls to the fixed network in case mobile handset is disconnected).

Architecture 3. Only provided by MNO.

Architecture 4. Can be provided by MNO without any fixed access and by full MVNO (to be able to localize users for billing purposes); it does not make sense for FNO.

Architecture 5. Can be provided by FNO with any type of MVNO with data services; it does not make sense for MNO.

2. SUBSTITUTION TRENDS

Q1: Please provide a summary of the existing FMC services in your country (use the previous section as a reference), with:

1. **Type of implementation**
2. **Identification of operator**
3. **Usage of fixed and/or mobile numbers, in both incoming and outgoing calls**
4. **Retail rates charged to the end user (equivalent to fixed or not)**
5. **When the fixed number is used, is the end user charged for incoming calls due to the fact that the operator has to terminate a mobile call?**
6. **Number portability: is it feasible that the user keeps its fixed number?**
7. **Eventual particularities of the service**
8. **Number of users being provided this service**

Please summarize results in the following table.

FMC Product (according to section 1)	Identification of operator	Numbering used in outgoing calls	Numbering used in incoming calls	Rates for outgoing calls	Rates for incoming calls	Extra charge when receiving calls to the fixed number	Number portability (keep previous fixed number)	Emergency calls allowed	Other particularities of the service	Number of users

Q2: Please specify the number of users in your country being provided exclusively mobile services (no fixed voice services provided).

3. SMP ANALYSIS ï FIXED AND MOBILE OPERATORS

Mobile operators can offer FM converging services by using the unbundling and/or bitstream offers. To compete, fixed operators require MVNO offers. In addition, the provision of FM services requires that mobile operators offer a number of additional features to MVNOs, such as: billing as a function of userôs location, fixed-mobile call forwarding, handover functionalities (hybrid terminals).

Q3: Which type(s) of MVNO services (see introduction) are available in your country?

Q4: Do you consider that fixed operators can obtain a wholesale offer with the appropriate level of features or on the contrary an ex-ante regulation to force such offer must be considered?

VoIP could be the main driver of fixed telephony; VoIP over mobile could be a solution for fixed operators to provide FMC services. In this case the end-user must subscribe to the mobile operator a mobile broadband connection, and the fixed operator cannot provide one stop billing.

Q5: Do you think that data MVNO (a kind of bitstream on mobile access) must be made available? Which level of functionalities do you estimate it must include? How should the provision of such offers be encouraged?

Q6: Do you evaluate that the different status between unbundling/bitstream offers on fixed networks and MVNO offers on mobile networks can distort competition between fixed and mobile operators? Do you see other causes of competition distortion between fixed and mobile operators?

Today the invoiced termination rate (and subsequently the retail price) depends on the number and not on the used network: when a mobile number is used (the most general case), a higher price is invoiced. As a consequence, if FMC services massively succeed the cost of voice calls risks to highly increase in the budget of end-users.

Q7: Do you estimate that FMC calls are in Market 3 or 7? Do you think that the definition of termination market(s) must be changed as a function of FMC?

Q8: Which is your view about numbers to be used in FMC services and portability between fixed and mobile voice services?

4. VOIP

With respect FMC services based on VoIP on a mobile broadband internet connection:

Q9: Is there an intention from NRAs to treat VoIP as data services?

Q10: How VoIP traffic is charged by the MNOs who are offering the mobile broadband connection: e.g. flat fee with volume cap or differentiated charging (price discrimination on the data traffic according to protocol, destination, domain etc)?

Q11: Do you think that mobile VoIP (unmanaged or managed) could become a substitute for the call termination service? If yes, to what extent? Have you investigated this issue in the Market 7 analysis?

Q12: Are you aware of MNOs proceeding in the implementation of mobile VoIP services in their network e.g. IMS?

Q13: It is still possible that non-geographic numbers are used so as to reach mobile VoIP users? Is the NRA aware of such service providers (Truphone, etc.) and have non geographic number ranges been provided to them?