EU REGULATION FOR INTERCONNECTION AND ROAMING

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Abstract

The purpose of the article is to focus on the regulatory issues in interconnection and roaming in mobile networks, mainly in Finland and the European Union area. Roaming in mobile networks describes a situation, where a subscriber of one operator uses the services of another operator, while in the foreign network coverage area. Roaming can happen at a national level between rival operators, or in an international setting, where the operators are located in different countries. In both cases the idea is to offer better coverage and service for the subscribers, albeit at an increased cost.

The different types of roaming are presented in the article, although technical detail is left on a general level. The focus is in 2G and 3G networks, so WLAN interconnection, for instance, is not included in the research. Regulatory issues are discussed regarding Finland and the European Union. Relevant markets and roaming charges are discussed in the final chapters and finally conclusions are drawn.

Keywords: roaming regulation, GSM, GPRS, 3G

1. Introduction

1.1. Roaming in mobile networks

The ability for a mobile subscriber to have network coverage, even while outside the area of the subscriber's operator, has been a key issue in GSM networks from the start. During the last few years with the increased global penetration of GSM networks, roaming agreements between operators have become a significant feature in service portfolios, offering in some cases near global coverage with a single subscription. For the subscriber the whole process is quite transparent, however the charges are generally much higher, averaging at 0.90€ per min excluding VAT for an outgoing call to the home network. Received calls are also billed, averaging at 0.50€ per min excluding VAT [1].

In the case of a small operator with little or no network of its own, the reasoning behind roaming agreements is quite clear. However, large operators with good network coverage also have a lot to gain from the roaming agreements, since the roaming charges in current models are quite profitable.

1.2. Roaming types and agreements

Roaming in mobile networks can be classified into four distinct categories [2].

- international roaming – the ability to use services of a another operator in a foreign country
- inter-regional roaming – the ability to use services of another operator in the same country where the operators have non-overlapping service areas
- national roaming – the ability to use services of a competing operator in the same country where the operators have the same or substantially overlapping service areas
- inter-technology roaming – roaming between different technologies, like 2G – 3G – WLAN

The first three of the roaming types are examined in this paper. The most interesting case is international mobile roaming (IMR), where roaming agreements are made between operators located in different countries. Operators typically want to have more than one roaming agreement for each country to ensure reliable coverage and tend to enter three roaming agreements per country on average [1]. In the end of year 2001 there were already over 20,000 roaming agreements between operators globally [2]. Sonera currently has GSM roaming partners in 158 countries with a total of 253 different operators [3].

The members of the GSM Association have adopted a framework for roaming agreements, which consists of Standard Terms of Roaming Agreements (STIRA) and the billing between operators, Inter-Operator Tariff (IOT). The framework limits roaming agreements between operators who are licensed and are members of the GSM Association. The roaming agreement states what kind of services are offered and at what price. The services can include voice calls, SMS delivery and data services.

Roaming agreements in their simplest form can be formed bilaterally between operators. In the case of large operators, the number of agreements can cause a lot of unwanted overhead when managing billing. However, it is also possible to obtain an indirect roaming agreement through the use of a roaming broker. Roaming brokers manage access and billing between operators and can be viewed as connection points from the operator's side. A

single operator can make use of economies of scale by making an agreement with a roaming broker and thus receiving connectivity to several operators at once. Roaming brokers are also members of the GSM Association and are bound by the same framework for roaming agreements.

1.3. GSM

The technical aspects of roaming in GSM networks are fairly simple. GSM users are identified by several attributes. The International Mobile Station Equipment Identity (IMEI) code of the handset can be used to uniquely identify and categorize handsets (blacklisted in case of stolen equipment for example). The International Mobile Subscriber Identity (IMSI), which is stored on the SIM card, contains information about the network and location of the operator that has issued the SIM. The Mobile Subscriber ISDN Number (MSISDN) is the assigned phone number of the user that consists of a country code (CC), a national destination code (NDC) and a subscriber number (for example +358-40-1234567). The Mobile Station Roaming Number (MSRN) is a temporary number assigned by the Visitor Location Register (VLR) of the visited network, which also contacts the Home Location Register (HLR) of the subscriber in order to get necessary information about the user and also to update the user's location into the HLR so calls can be routed correctly. Finally the VLR of the foreign network can assign a Temporary Mobile Subscriber Identity (TMSI) to the mobile station for purposes of internal routing.

In the case of several available Public Land Mobile Networks (PLMN), the user may manually choose one of the options based on the roaming agreements of the subscriber's operator, or let the network do an automatic selection. In most cases the automatic selection procedure will produce the best choice based on signal level and pricing, but a user may want use some specific services from another network in which case manual selection is needed.

The two cases for mobile call interaction are when the subscriber makes a call and when he receives one. The first case is called a Mobile Originated call (MO) and the latter a Mobile Terminated call (MT). In terms of routing and roaming only MTs are significant, since a MO is routed like any other call after the connection to a base station is achieved. When someone makes a call to a mobile subscriber, the call is first routed into the mobile subscriber's home PLMN based on the NDC part of the MSISDN. The location (MSRN) of the mobile subscriber can then be received from the HLR. The call is then routed to a mobile switching center (MSC) in the appropriate network. The MSC must then query the VLR using the MSRN in order to receive the TMSI of the subscriber and to establish the connection.

1.4. GPRS and 3G

The data network requirements in GPRS obviously require a different solution for roaming than with GSM voice calls. The GSM Association has identified two approaches for GPRS roaming [2]:

- ISP roaming – the visited network provides the GPRS service including interconnection to the Internet
- Home Public Land Mobile Network (HPLMN) – the home network provides the GPRS service and the visited network only provides air interface connectivity and routes the traffic back to the home GPRS gateway nodes

The pros of ISP roaming are lower price and greater efficiency. However, the security of the user cannot be guaranteed by the subscriber's home operator and service level may vary. HPLMN on the other hand provides good security for the user and better quality on the connection. The home operator can also track its customers more efficiently.

HPLMN implementation requires operators to have IP connections between the mobile networks. Several approaches can be used, like with all IP based communication. Leased lines offer good capacity and security, but are usually too expensive for operators to implement. VPN tunneling through third party carriers is an option, but like with bilateral roaming agreements, the amount of connections to other operators can grow too large. Sonera, for example, provides GPRS services in 60 countries with 94 different operators [3].

Operators now have an option similar to Internet eXchanges – the GPRS Roaming eXchange (GRX). GRXs provide dedicated IP connections between GPRS networks and are connection points for operators, who want to exchange roaming information with others. Only mobile roaming traffic is transferred in the network, which provides good security and efficiency. TeliaSonera's GRX model is presented in Figure 1 [4].
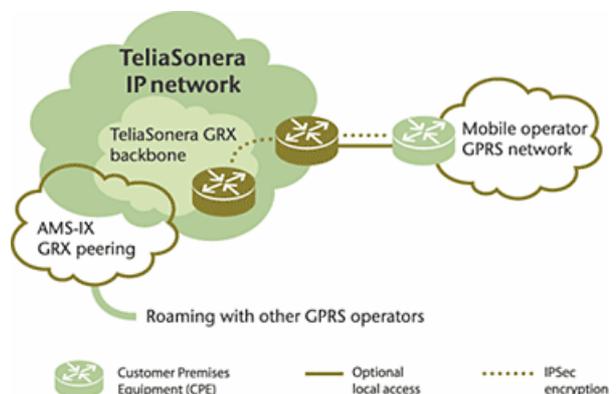
Figure 1. TeliaSonera's GRX model

At the moment only two GRX peering points exist: one in Amsterdam and the other in Singapore. The GRX operators themselves can operate with different service portfolios ranging from basic connectivity to value-added services (DNS, network management) and billing. Concerning roaming agreements in the GRX model, the same framework applies as in GSM voice calls. Roaming brokers are still used, and some of them are also GRX operators. One specific feature of GPRS roaming agreements is traffic fees, which are usually volume based.

3G traffic is handled basically in the same way, since it is IP based, and some GRXs already support UMTS traffic in addition to GPRS [3].

2. Regulation

2.1. Regulation in the European Union

On 10th November 1999 the European Commission reviewed the existing regulatory framework for telecommunication under a communication titled "Towards a new framework for electric communications infrastructure and associated services – the 1999 communications review". In the communication some policy proposals were also made for a new regulatory framework for public consultation [5].

In 2002 the new regulatory framework was finally realized under the following directives [5]:
- Framework Directive
  (DIRECTIVE 2002/21/EC)
- Authorisation Directive
  (DIRECTIVE 2002/20/EC)
- Access Directive
  (DIRECTIVE 2002/19/EC)
- Universal Service Directive
  (DIRECTIVE 2002/22/EC)
- Processing of personal data and the protection of privacy in the telecommunications sector
  (DIRECTIVE 97/66/EC)

The reasoning for the new regulatory framework was to create a consistent framework for the converging technologies in communication networks. The aim was also to increase competition in relevant market areas, as the competition law itself is not enough to ensure competitive markets. All national regulatory authorities (NRA) of member states were to realize the new framework by 25th July 2003. The required actions included analyzing and defining electronic communications markets and players, and possible significant market powers (SMP). If there were no SMPs in a single market area, it could be declared competitive without the need for ex ante regulation. Figure 2 presents the basic steps of the process [6].
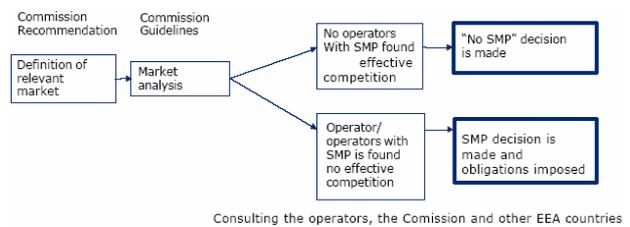
Figure 2. Analyzing markets by FICORA

In order to find a relation to mobile roaming in the framework, the relevant market areas must be examined. The following markets were identified for voice services at non-fixed locations [5].

Retail level (end user markets):
- No specific markets were defined

Wholesale level (business to business markets):
- Access and call origination on public mobile telephone networks
- Voice call termination on individual mobile networks
- National market for international roaming services on public mobile telephone networks

For wholesale SMS services no market was defined. While in some cases SMS may be a substitute to a short voice call, the termination and duration aspects separate it from the wholesale voice call markets. Regarding other data services and networks (GPRS, UMTS, etc), the retail markets are still very undeveloped. It is also difficult to foresee how the voice and non-voice services and pricing will develop in the third generation networks. On this basis, no retail of wholesale market was defined for data services in the recommendation for relevant markets [5].

As the markets for GPRS and 3G roaming services are still difficult to define, it is my understanding that the general competition law and relevant consumer protection regulation is followed until a mature wholesale market emerges.

2.2. Regulation in Finland

In Finland the national regulatory authority is the Finnish Communications Regulatory Authority (FICORA). The new directives were implemented by the new Communications Market Act on 25th July 2003, as required by the new regulatory framework. Finland was one of the few countries to enact the directives on time. The new act allows FICORA to make decisions on significant market power, which has not been possible before [7].

FICORA is also working actively with the Finnish Competition Authority (FCA), since both organizations

are responsible for creating and maintaining competition on the communications market. Through the analysis and definition of markets and significant market powers, FICORA's role as a promoter of competition is emphasized.

3. Markets and charges

As discussed earlier, markets can be split into two main categories. Retail markets refer to markets, where operators offer services to end users. In the case of roaming, these can simply be making and receiving calls. Wholesale markets deal with services between two (or more) operators, like in the case of roaming agreements.

The reason for defining markets is to find a consistent way of evaluating, whether there is sufficient competition or not. In trying to define relevant markets, two guidelines can be used [1].

- A relevant product market, on which competition can be rated
- A relevant geographical market

In its recommendation on relevant markets, the Commission has defined 18 relevant markets in total (4 retail, 14 wholesale) [1]. Three mobile wholesale mobile markets are included, as presented in chapter 2.1. Legally, a NRA is not allowed to regulate the retail roaming market unless it would define it as an additional relevant market [1]. However, retail markets can be defined as additional relevant markets by the NRAs if regulation on the retail market would be beneficial to competition in the particular case.

3.1. International roaming charges

In this chapter the roaming charges for international roaming are examined for both voice calls and data services where available. The relevant market for international mobile roaming can be characterized as national on the geographic level, since roaming in another country is not a substitute service [1].

The charges in mobile roaming are mostly cost based. The operator charges subscribers based on the roaming agreement with the foreign operator in question. A certain amount is added to the negotiated price to create a profit margin. In the case of (near) global coverage, the tariffs can be grouped based on the location of the geographical zone. Tariffs of operators may differ in other ways as well, for example in the granulation of the duration of calls.

Sonera, for example, has recently divided its billing scheme into six tariff zones, where MO calls range from 0.77€/ min to 2.95€/ min and MT calls from 0.37€/ min to 1.65€/ min. GPRS data transfer varies from 0.29€/ 50kB to 0.6€/ 50kB and SMS charges are the same on every zone (0.29€). In this pricing scheme it is

interesting to note, that while the "rest of the world" zone has the highest voice call charges, the data transfer charges are the lowest [3]. The six zone division seems to be favored, as big operators like Vodafone and O2 apply it in their pricing as well.

The International Telecommunications Users Group (INTUG) made a survey at the Athens Olympics 2004 in Greece about the prices of international mobile roaming for visitors to Greece at the time [8]. The survey includes information about voice calls, text messages and GPRS data transfer. Table 1 shows the range of prices for all these services for European operators. The prices are in euros and the unit for voice calls is €/ min, and €/ MB for GPRS.

Table 1. Roaming charges in Athens 2004 survey

MO call to a number in Greece		MO call to home country		MT call		SMS		GPRS	
Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
0,36	1,13	0,65	1,39	0,24	1,13	0,13	0,75	5,00	25,00

As the results of the survey show, there are great variations in tariffs, all of which can not be explained by cost differences in different countries. Especially in the case of GPRS data charges, the relation to operator costs is minimal. According to INTUG, the GPRS roaming prices are so high at the moment, that nobody should be using these services.

When a roaming user calls another roaming user, the charges get even higher. The caller must first pay the tariff of calling the country of the other user, who then pays the tariffs to bring the call to the country the user is located at. Some operators do offer "happy hour" kind of deals, where a call home at a certain time will cost less than usual, but a casual user will not see much benefit from these deals. Also with the arrival of pre-paid subscriptions, the billing of roaming calls has gotten more complex for the user. INTUG concludes that while the data they have gathered for pre-paid subscriptions is not comprehensive, the charges seem to be much higher than with post-paid roaming and the choice of networks smaller while roaming.

3.2. Charges in Finland

As the networks of the 3 large operators TeliaSonera, DNA (Finnet) and Radiolinja (Elisa) cover most of the country, there is little need for inter-regional or national roaming in Finland. Mobile virtual network operators (MVNO), like Saunalahti already have a contract with one or several of these network providers for coverage, so roaming is not an issue to the end user in these cases either. One operator with roaming agreements to the network operators in Finland exists, however. Ålands Mobiltelefon Ab operates its own mobile network in

Åland, Finland. It has roaming agreements with Elisa and Finnet [9].

Pricing in Finland is cost-oriented for retail markets and price regulation is focused more on operators' wholesale prices (interconnection and local loop for example) [7].

4. Conclusions

Despite investigations by the European Commission, the mobile network operators have been able to boost their profits in roaming. It is often difficult for the end user to know how much they are being charged, since even at their simplest, the tariffs may vary depending on the zone the user is in and the destination of the call. The prices for data services while roaming are even more outrageous and even with all the complexity and overhead in pricing, it is still the subscriber's responsibility to make sure they are not getting ripped off.

It seems that the European Commission has some work ahead still.

References

[1] Hylkema, Roderik: Competition in International Mobile Roaming, Delft University of Technology, 2003

[2] Pohjola Olli-Pekka, Kumar K. R. Renjish, Heikki Hämmäinen: Roaming Dynamics in GPRS and Beyond: Options and Strategies

[3] Sonera – Mobile Abroad, URL: http://www.sonera.fi/eng/CDA.COM.ArticleFrame/ 0,1395,expandSize%3D2%26expandLevelId%3D65 12_620_%26hierarchyId%3D6512,00.html

[4] TeliaSonera GRX IP, URL: http://www.teliasonera.com/ts/teliasonera/sidtypTS_ 11.do?tabId=0&channelPage=%2FsidtypTS_11.do &channelId=-90081

[5] Regulatory framework for electronic communications in the European Union, Situation in September 2003, URL: http://europa.eu.int/comm/competition/liberalization /legislation/regulatory_framework.pdf

[6] FICORA, Significant Market Power, URL: http://www.ficora.fi/englanti/document/Significant_ market_power.pdf

[7] Juusela, Johanna: Communications regulation in Finland, 2004

[8] INTUG - Olympics 2004, International mobile roaming charges, 2004, URL: http://www.intug.net/surveys/gsm/olympics/

[9] GSM Åland homepages, URL: http://www.gsm.aland.fi/