

MVNO Pricing Structures in Finland



Authors (from body; name, chairman and secretary of the body) J. Kanervisto Consulting		Type of publication Report	
Jukka Kanervisto		Assigned by Ministry of Transport and Communications	
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Abstract <p>This study deals with the operation, traffic and pricing of Mobile Virtual Network Operators (MVNOs) in relation to licensed Mobile Network Operators (MNOs) and to Service Providers (SP) operating the networks of licensed MNOs. MVNOs do not have radio networks of their own. They operate in the networks of licensed MNOs (hosting operators) by leasing a radio access from them. The number of MVNOs is increasing in the European telecommunications market.</p> <p>In the study, MVNOs have been defined as network operators, being able to establish their interconnection agreements with other network operators. As network operators, they are comparable with licensed MNOs regarding regulation of network services. In the study, the need of SMP regulation and the impact of SMP obligations to MVNOs has been assessed. Also the relation of an MVNO and its MNO has been studied with regard to traffic and its pricing.</p> <p>The study gives a clear indication of pricing distortion of mobile services. A regulated, cost-oriented termination price is not in right relation to other unregulated wholesale and retail prices. The pricing problem is not the price by which MNOs sell radio access to MVNOs. The problem is the regulated termination rate of MNOs having SMP. The problem of termination charging cannot be removed by the demand of cost orientation, if it does not lead to cost oriented prices. The current cost calculation mechanisms have not led to cost-oriented charges.</p> <p>The study suggests the definition of MVNO to be included in the legislation and measures by which the traffic between an MVNO and its hosting MNO would be made equal and non-discriminatory in relation to other network operators and service providers. It was also found out in the study that requirement of cost-based termination charges for MVNOs would lead MVNOs into difficulties.</p>			
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Preface

The EU Directives divide communications operators into two main categories, service operators and network operators. The latter are concerned with wholesale prices whereas the former have the rights for consumer pricing. In a healthy business environment, these two correlate with one another to a certain extent.

In the communications markets, new players have emerged in the operator sector that are difficult to define; they are not directly service operators but they are not network operators either. As a result, they have been called virtual network operators, which is a term that is not defined in the Directives. This issue has attracted a lot of attention and has been widely discussed in the field of mobile communications. It is very topical in the context of developing the sector.

The report aims at opening discussions on the matter and further developing the Directives and the field. This is important in order to achieve a well-functioning and healthy business environment in communications.

The report also suggests improvements to the present situation.

The views and proposals in the report are on the sole responsibility of the author and they do not represent the official position of the Ministry of Transport and Communications.

I wish to thank the author, Mr Jukka Kanervisto from J. Kanervisto Consulting Oy, for his valuable work.

Helsinki, February 2005

Kari T. Ojala

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1 Executive summary

The purpose of this report is to survey the pricing structures of the Finnish Mobile Virtual Network Operators (MVNO). MVNOs are not explicitly defined in the Finnish Communications Market Act, although the explanatory memorandum of Article 23 of the Act allows for operation of MVNOs but where MVNO has been defined as an enhanced service provider, which connects its equipment to the network of its hosting Mobile Network Operator (MNO)

On an international level, MVNOs are understood in many different, often misleading ways. Sometimes the acronym MVNO means only service provider, sometimes network operator and sometimes both service provider and network operator. In this report, MVNO is defined as a network operator, which leases a radio access from its hosting MNO. Radio access is needed in order to connect MVNO's subscribers to MVNO's mobile switching centre (MSC). MVNO is able to connect its network to the networks of other network operators and to establish interconnection agreements with them.

Virtual mobile activity is an extension of mobile service provisioning. Mobile service providers (SP) acted in the very beginning as resellers of their hosting mobile operators. Their services were limited to services of their hosting MNOs in the very beginning but have grown later on and nowadays many Service Providers have their own equipment, by which they can provide and price their own services quite independently in the network of their hosting MNO. They may have their own SIM card (Subscriber Identity Module) and their own MSC and Home Location Register (HLR). They have become Enhanced Service Providers (ESPs) within the network of their hosting MNO. ESPs are still service providers; they are not independent network operators. They lease the necessary network services from their hosting MNO and their traffic to other operators goes through the hosting MNO. From ESP, it is a short way to MVNO, which use their own MSC to switch their calls and to interconnect their networks to networks of other operators and to make interconnection agreements with them.

Internationally, MVNO activity is just in a starting phase. At the moment there are about 100 mobile service providers in Europe, out of which only few are MVNOs as defined in this report. In Finland, there are two MVNOs: Saunalahti and Tele2. Their market share is about 9% of all Finnish mobile subscriptions. Total market share of Finnish SPs and MVNOs is about 13%. In Sweden only one MVNO exists: Telenor Mobile, whose market share is about 1% of Swedish mobile subscriptions. Total market share of Swedish SPs and MVNOs is 4,3%. In Denmark there is also one MVNO, Tele2, whose market share is less than 3%. Total market share of SPs and MVNOs in Denmark is 24%. In the UK, regarding the definition of MVNO in this report, no MVNOs exist. The market share of service providers there is 13%.

When assessing the pricing structures of MVNOs, main focus has been 1) the differences of operational and pricing structures between service providers, MVNOs and MNOs, 2) pricing of traffic between MVNOs and their hosting MNOs and 3) regulatory needs for MVNOs. This report ends up to the following conclusions:

Definition of Mobile Virtual Network Operator

MVNO is not defined in the Communications Market Act. There are significant operational and pricing differences between mobile service providers, mobile virtual network operators and mobile network operators. Without a definition of Mobile Virtual Network Operator, interpretation of the Communications Market Act and issuing of new regulatory obligations is problematic. Definition of Mobile Virtual Network Operator should be included in the Communications Market Act.

Pricing of traffic between Service Providers and their hosting MNO

A call between subscribers of a service provider and its hosting MNO is operationally and with regard to costs the same as a call between subscribers of the hosting MNO or between subscribers of the Service Provider. When wholesale prices of on-net calls are not regulated, and when calls do not go through the point of interconnection, wholesale prices of calls between the Service Provider and its hosting MNO can be agreed commercially between them. This set competing service providers in unequal position: in calls between the service provider and its hosting MNO, no termination charge is collected but in calls from other services providers to the MNO and its service provider, termination charges are collected. This inequality is difficult to be removed: on-net calls do not go through the point of interconnection. In addition, division between a reseller and competing, independent Service Provider is difficult to find. In the first case, separation of calls between the reseller and the hosting MNO should not be done, in the latter case it possibly should be done for the sake of non-discrimination and equal treatment.

Pricing of traffic between MVNO and its hosting MNO

Virtual network operator with its own independent interconnection links is an independent network operator which competes with its hosting MNO. MVNO switches its calls in its own mobile switch. As mentioned above, traffic between SPs and their hosting MNOs does not go through the point of interconnection. This puts other network operators and Services Providers into unequal positions in relation to the hosting MNO and its service provider. This distortion gets even worse, if the same will be allowed between the MVNO and its hosting MNO. Switching of calls between MVNO's subscribers and its hosting MNO's subscribers only in MNO's switch should be prohibited. For the sake on non-discrimination and equal treatment, all calls between the MVNO and its hosting MNO should be routed via the point of interconnection. Corresponding enactment should be included in the Communications Market Act.

Pricing of MVNO call termination

Regarding call termination, virtual network operator does not differ from other network operators. It is in a monopoly situation regarding call termination to its network: call to MVNO's subscriber goes through its point of interconnection and prices for call termination are defined by the MVNO. With lacking competition in call termination, MVNO has no natural interest to reflect possible savings in increased efficiency or call conveyance to interconnection charges. Regarding designation of operators having Significant Market Power (SMP), MVNO's call termination should be analysed in a similar manner to that for MNOs.

Regarding possible SMP obligations, MVNOs differ from MNOs, however. Contrary to MNOs' termination costs, MVNO's termination costs are easily defined. The cost of MVNO call termination consists of 1) the costs of MSC and related equipment added by 2) cost of the radio access needed from the MVNO's MSC to MVNO's subscriber. The latter cost is easily available; no complicated cost analysis is needed. The cost is contracted leasing price of MNO's radio access which is commercially agreed between the MNO and the MVNO. In practise, this leasing price can be even half of the MNO's regulated termination charge. When the cost of an MSC is marginal to the cost of a radio access network, MVNO's cost-oriented termination price would be significantly less than its hosting MNO's "cost-oriented" termination price. If MVNO would be imposed to price its call termination as cost-oriented, it would lead MVNO into a difficult position: it could not subsidize its services from termination charges but the MNO could still do so. On the other hand, leaving MVNO totally out of termination charge regulation would likely lead to problems such as excess termination charges by the MVNO. With excess termination charges, MVNO could better than MNO subsidize its other services. When considering MVNO's SMP obligations, special attention should be addressed to problems of cost orientation and to requirements of reasonable pricing and non-discrimination.

Pricing of MNO call termination

This report gives clear indication that MNO termination charges do not correspond with requirements of cost orientation. MNO's regulated termination charge is something else than unregulated radio access which MNO's sell to service providers/MVNOs in the form of call origination, call termination or on-net calls. Call origination uses the same network elements as call termination and its cost is, therefore, of the same magnitude as call termination. Correspondingly, cost of a network internal call (on-net call) is of the same magnitude as sum of costs of call origination and call termination. This is seen in no way in commercial retail prices. A simplified price/cost analysis made in this report gives clear indication that call termination subsidize significantly other mobile services and therefore causes a significant price distortion. It may be seen exacerbating that retail prices are less than wholesale prices. Call termination has become a significant source of revenue to mobile operators although with SMP regulation this was just an issue intended to be avoided.

It is to be noted, that termination charges in Finland are the third cheapest in Europe. If termination charges significantly subsidize other mobile services in Finland, what would be the situation in other European countries? Or is it so that call termination charges are after all cost-oriented and all retail charges are significantly under cost?

Calculation of a cost-oriented price is a complicated process and a real price that is based on costs involved is almost impossible to calculate. All calculation methods include, in addition to cost data, variables that cannot be measured. They have to be estimated. These are for example cost and traffic division between different services. Division is necessary because of the fact that the same functions and the same network elements serve several different services. Other figures needing estimation are risk premiums, reasonable profit, depreciation in relation to economical lifetime of different network elements, efficiency of investments, cost of calculated networks compared with costs of an efficient operator, cost directed to operation and maintenance of different services etc. The list could be

extended. Cost calculation includes so many variables and so many suppositions that the resulting “cost-oriented” price does not necessarily reflect the real costs of call termination.

The problems of call termination cannot be removed by the requirement of cost orientation if it does not lead to cost-oriented termination charges. Existing cost calculation mechanisms have not led to cost-oriented prices. Regulatory pricing of call termination has failed in this respect. In order to remove the pricing distortion, pricing should be tied to market prices in a manner or another or by other means to right relation with the costs and pricing of on-net calls.

Impact of MVNOs to service- and network competition

If an MVNO succeeds to make a leasing contract of radio access with two or several MNOs, it becomes a superior network operator. The coverage of its network is the combined coverage of its contracted networks, it can contest the radio path of all its contracted MNOs and route the traffic to its customers via the network which is the cheapest. No MNO can do this alone. In order to be able to compete with MVNOs, MNOs have to establish their own MVNOs. The focus of competition will turn from service and network competition to service competition on the expense of network competition. It may lead to lessening of interest to network investments. In case of networks with nationwide coverage, this concern may not be very essential. A question arises, however, who builds the networks in the still remaining unprofitable areas? Regarding 3G networks, this concern may prove to be more relevant. Their coverage is still limited. MVNOs ability to make contracts with several MNOs simultaneously and its impact to service/network competition should be discussed in further detail.

Views expressed in this report belong to the Author alone. They do not reflect the views of the Ministry of Traffic and Communication of Finland, neither the views of the Finnish Communication Regulatory Authority nor the interviewed operators or other entities.

2 Development of mobile services

Mobile market have developed to a situation where, in addition to conventional licensed mobile operators, new independent mobile service providers (SP) and mobile virtual operators (MVNOs) have entered in the market and who offer their services in the networks of licensed mobile operators.

Service Providers provide their services as resellers of their hosting mobile network or they can own and administer equipment by which they are able to produce their own services with their own brands. In more sophisticated solutions they may own their own mobile switch, HLR and related equipment and develop services that compete with services provided by the hosting mobile operator. All service provisioning to its customers and interconnection to other networks takes place still in the network of the hosting mobile network operator.

MVNOs provide their services as network operators having their own interconnection links with other network operators and their own interconnection agreements. They lease the necessary radio access from their hosting MNO. Leased radio access is necessary in order to connect their subscribers to their mobile switch.

It is estimated that there are about 100 mobile service providers/virtual mobile operators in the European mobile market¹ and their number is growing rapidly both in Europe and other parts of the world. This is probably due to increasing competition between licensed mobile networks and along with competition increased free network capacity. Tightening competition is also a consequence of mobile number portability. Spreading of mobile service providers had led to price competition but it has also brought more traffic to the networks of licensed mobile operators.

In Denmark, nice priced SPs/MVNOs use Internet as their marketing channel. They send their SIM-cards by mail to their customers, they bill their customers via Internet or SMS². Nice priced SPs have caught up 23% market share of the Danish mobile call market and 30% market share of the Danish SMS-market. During the year 2004 mobile call prices have decreased in Denmark about 50% and price of a mobile call in Denmark is of magnitude 7,5 Euro cents/min (VAT excluded) by the end of 2004. Cheapest day-time mobile call prices in Finland vary (depending of the type of subscription) from 5,7 to 21,3 Euro cents/min between mobile networks (VAT excluded) and from 1,6 to 14,8 Euro cents/min within the same mobile network (see appendix Retail and wholesale prices).

Regulatory environment

In the very beginning, licensed MNOs (Mobile Network Operators) opposed entering of SPs and MVNOs in the market by refusing the network lease or making the market entry difficult by other means. MVNOs requested regulatory actions in order to open MNOs'

¹ Goldman Sachs, Total Telecom November 2004

² ITU Asia 2004: Will discount operators kill MNOs?

network. Since then, MNOs attitude has been changed and MVNOs have been considered not only as entities to increase competition but also entities to increase benefits of MNOs. According to a Swedish study³, grounds for a MNO to select an SP or an MVNO include inter alia:

- Reaching or testing of new market segments
- Filling the free network capacity
- Risk sharing by using several service trade marks
- Sharing network investments
- Quick manner to increase traffic in the network
- Introduction of new services which supplement existing services
- Increasing of internal competition

In order to open MNOs network to MVNOs, regulatory obligations are imposed to MNOs only in Norway, Denmark and Ireland (in Ireland only for 3G networks). In most European countries legislation gives the regulator means to set obligations to operators having been defined as SMP (Significant Market Power) operators, including obligations for MVNO access, if found appropriate.

In spite of the missing regulation that would oblige MNOs to share their infrastructure with SPs/MVNOs, the number of SPs/MVNOs have increased significantly. From the “old” EU countries, only in Greece, Ireland, Italy and Portugal, no SPs/MVNOs exist. It is likely that no special need exists for further MNO-obligations with regard to opening the market for MVNOs. On the contrary, MVNO operation may need some new rules in order to guarantee well functioning mobile market.

3 What is MVNO?

Mobile virtual network operators are not defined in the Communications Market Act⁴ and no explicit definition can be found in the legislations of other countries. The use of the

³ Nätoperatorers val av MVNO – förutsättningar för lönsamma samarbeten, The Infocom Research Program, Institute of Economic Research, Lund University, Sweden, 2002/5

⁴ Communications Market Act, 23.5.2003, definitions:

Communications network

means a system comprising cables and equipment joined to each other for the purpose of transmitting or distributing messages by wire, radio waves, optically or by other electromagnetic means;

Mobile network

means a communications network primarily used for targeted communications in which the terminal equipment is connected to the communications network by means of freely propagating radio waves;

Fixed telephone network

means a communications network primarily used for targeted communications in which the terminal equipment is connected to the communications network by a cable or other leased line;

Telephone network

means a mobile network or a fixed telephone network;

Service operator

abbreviation MVNO is ambiguous in the international language. From the user point of view, all other than licensed mobile operators are virtual operators because they do not have their own network. This definition has been used in many international source documents. In some documents, MVNO is defined (in accordance with its abbreviated form) an entity which acts as a virtual network operator who has leased a radio access from the licensed mobile operator.

Provision of network services and telecommunications services is illustrated in figure 1. The presented model is applicable also to describe differences between service provisioning and network provisioning in the fixed network.

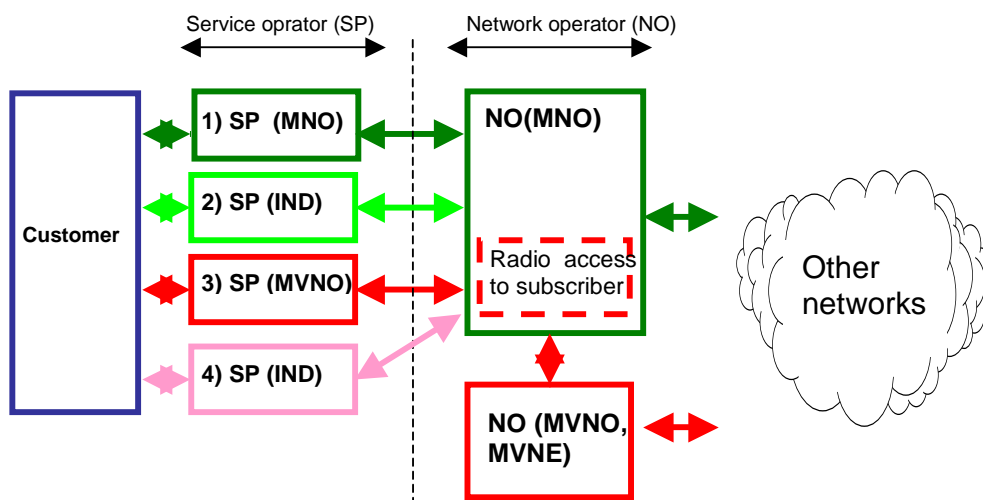


Figure 1. Mobile service operators and network operators

Mobile service operators and network operators can be divided as follows:

Network operators

Network operators are entities that provide wholesale services. They own or administer their network which they use for the provision of their network services to service providers. Network operators do not sell their services to end users.

Network Operators can be divided to:

-
- means an operator that transmits messages over a communications network in its possession or obtained for use from a network operator or distributes or provides messages in a mass communications network;
 - Network operator
 - means an operator that provides a communications network in its ownership or for other reasons in its possession for the purposes of transmitting, distributing or providing messages;

- licensed mobile network operators (MNO). MNOs sell their network services to service providers (SP)
- mobile virtual network operators (MVNO) or mobile virtual network enabler (MVNE). MVNOs and MVNEs operate like MNOs but they do not have their own radio infrastructure. They lease the right of use of radio infrastructure from the licensed mobile network operators. They have their own SIM-card that is independent from the MNO's SIM-card, they can have their own numbering resources, they can have their own infrastructure to provide, brand and prices their own mobile services. MVNOs and MVNEs can establish their own interconnection agreements with other network operators.

Abbreviation MVNO is used to describe a virtual mobile network operator having its own, vertically integrated service provider. Abbreviation MVNE has been use for the mobile virtual network operator having no own vertically integrated service provider. MVNEs provide mobile virtual network services only to independent service providers.

Service Operators (SP)

Service Operators do not have their own network. Therefore, in order to provide their services, they have to purchase network services either from MNOs or from MVNOs. Switching of calls and interconnection to other networks is carried out by the hosting MNO or MVNO. Service operators can be divided into ordinary service providers (SP) or providers of enhanced services (ESPs) as follows:

- **Ordinary service providers (SP)**. SPs sell usually products of their hosting MNO, either with MNO's brand or with their own brand. They can carry out specific actions independent of the MNO, e.g. opening or closing the subscription, billing the customer and they may have number space of their own. Regarding network services and interconnection they are totally dependent on the services of their hosting MNO.
- **Providers of enhanced services (ESP)**. They can have SIM-card of their hosting MNO with their own brand, they can have their own number space, they can provide enhanced services and own and administer equipment for the provision and branding those services. They purchase network services from their hosting network operator. Interconnection to other network is carried out by the hosting MNO.

Regarding the ownership, service operators can be divided (ref. numbers used in figure 1):

- 1) To the MNO vertically integrated service providers SP (MNO). These are together with the MNO, either the same company, companies within the same consortium or they have other close ties with the hosting MNO
- 2) To independent service providers SP (IND). These are independent entities from the hosting MNO.

- 3) To MVNO vertically integrated Service Providers SP (MVNO). These are together with the MVNO, either the same company, companies within the same consortium or they have other close ties with the hosting MVNO
- 4) To independent service providers SP (IND), which lease their network services from Mobile Virtual Network Operators (MVNO) or Mobile Virtual Network Enablers (MVNE).

In this report, mobile virtual network operator is understood as a virtual network operator MVNO and MVNE as in figure 1. It can offer its network services either to its vertically integrated service provider or to a service provider which is independent from the hosting virtual network operator. Licensed MNOs offer MVNOs only the radio access which is needed to connect MVNO's subscribers to MVNO's mobile switch.

4 MVNO traffic modes

In the following, MVNO traffic modes in relation to interconnection are studied in further detail. Also some general remarks have been made with reference to the costs of interconnection. It is to be noted that when estimating the costs of interconnection, no attention has been paid to one-time costs which are born by the agreement, establishment, testing and opening of interconnection. One-time costs create a certain start-up threshold for MVNO service provisioning.

4.1 Interconnection between MVNO and other networks

4.1.1 Call origination

MVNO's originating traffic can take place in two alternative ways: 1) traffic through its own point of interconnection (based on the definition of MVNO) or 2) traffic through the point of interconnection of its hosting MNO (based on the definition of ESP)

4.1.1.1 Traffic through the point of interconnection of an MVNO

Outgoing traffic from MVNO's subscriber goes through MNO's Base Station (BTS) and Base Station Controller (BSC) to MNO's mobile switch (MSC). Based on the information collected from MNO's Visiting Location Register (VLR), call is routed to MVNO's MSC and the Home Location Register. Based on the information recorded in the HLR, call is then routed by the MVNO to other networks, figure 2.

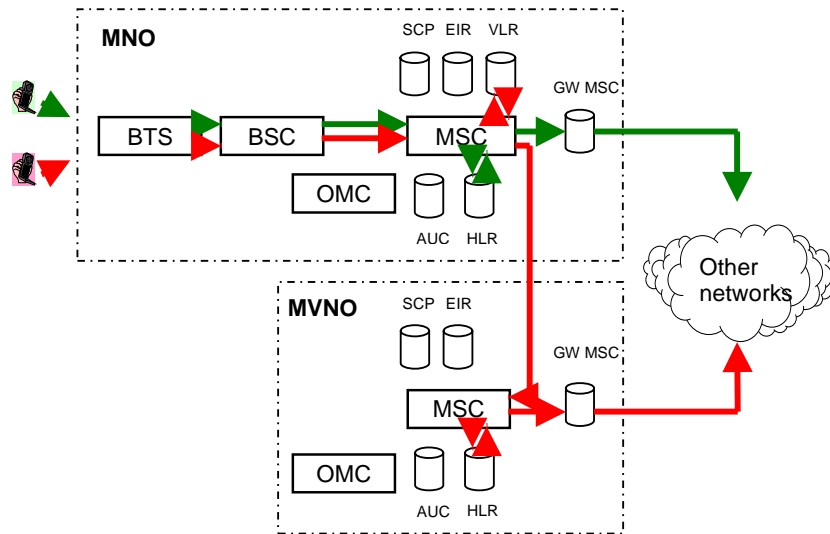


Figure 2. MNO's and MVNO's outgoing traffic to other networks through the point of interconnection

The cost of MVNO's call origination is comparable with the cost of call origination of the hosting MNO. Taking into account of MVNO's cost of MSC and related equipment, the cost of MVNO call origination can be slightly higher than the cost of MNO's call origination. It is to be noted, however, that the difference may be marginal: most costs are born from radio access infrastructure, base stations, base station controllers and transmission⁵

4.1.1.2 *Outgoing traffic through the point of interconnection of the hosting MNO*

Another alternative for MVNO outgoing traffic is to route it through the point of interconnection of the MNO, figures 3 and 4. Functionally "MVNO" differs from other MNO's service providers only with regard the service level and scope. By definition, lacking interconnection link of its own makes "MVNO" an ESP, not a real MVNO.

⁵ Cost Structures in Mobile Networks and their Relationships to Prices. Final Report for the European Commission by Europe Economics, 28 November, 2001

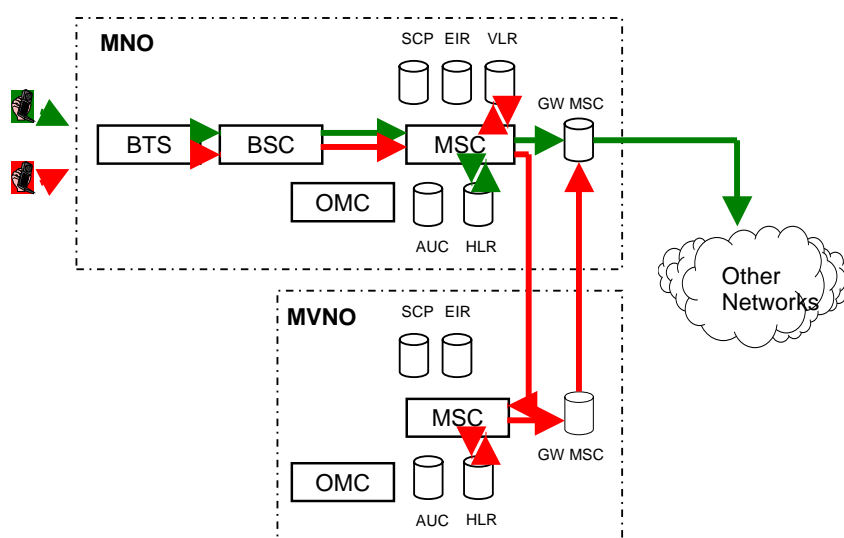


Figure 3. "MVNO"'s outgoing traffic via its own MSC and the point of interconnection of the hosting MNO.

"MVNO"'s outgoing traffic can also be routed out directly from MNO's MSC, figure 4. Updating MVNO's MSC takes place with signalling. In this alternative, the use of MVNO's own IN platform is limited.

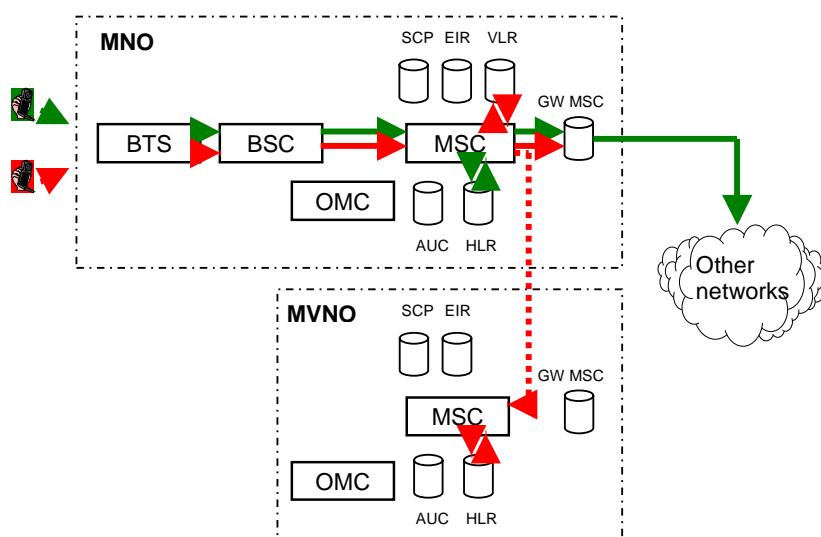


Figure 4. MVNO's outgoing traffic directly from the hosting MNO

4.1.2 Call termination

Also terminating traffic to MVNO can be routed in two alternative ways: 1) Via MVNO's own point of interconnection or 2) via MNO's point of interconnection.

4.1.2.1 Call termination through MVNO's own point of interconnection

A call to MVNO's network is routed via its own point of interconnection. Call is routed to MVNO's MSC and Home Location Register. Based on information recorded in the Home Location Register, call is routed to MVNO's subscriber through MNO's radio infrastructure, figure 5.

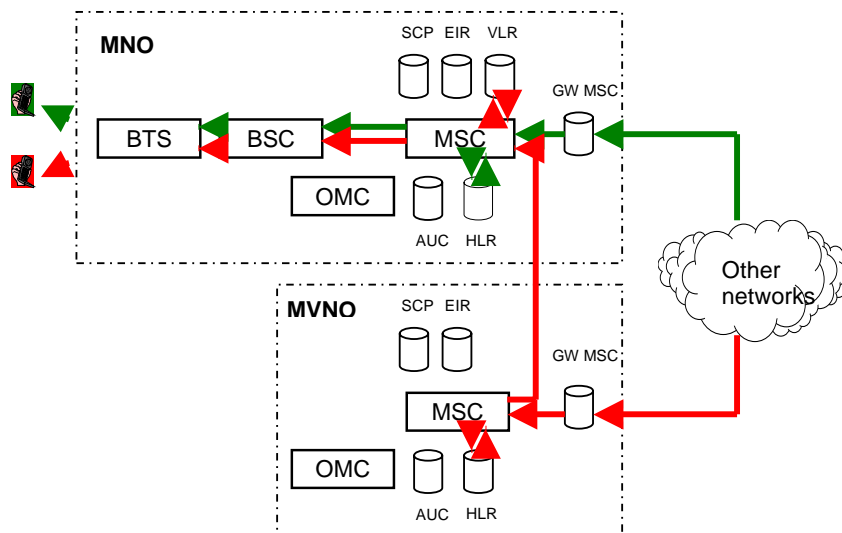


Figure 5. MNO's and MVNO's call termination via their own interconnection links

Similar to call origination, the cost of call termination in the MVNO's network may be slightly higher than the call termination in the MNO's network, because of some parallel network components (MSC, for example). Difference is marginal, however, taking into account that the bulk of total costs are born by the radio infrastructure (BTS, BSC and transmission links)⁶.

4.1.2.2 Call termination through the interconnection point of the hosting MNO

A call to "MVNO"'s subscriber can be routed via the gateway MSC of the hosting MNO, figure 6. From MNO's MSC call is routed to "MVNO"'s mobile switch MSC, to its HLR and then through MNO's radio access to the "MVNO"'s subscriber. "MVNO" is tied with MNO's interconnection links and –prices. A call can also be routed to "MVNO"'s subscriber directly from the MSC of the hosting MNO, figure 7.

In both alternatives, "MVNO" is tied with interconnection of the hosting MNO. Functionally "MVNO" differs from normal SPs of the hosting MNO only with regard to the scope and level of services. In fact "MVNO" is not a virtual network operator as defined in this report, but an ESP of the hosting MNO.

⁶ Cost Structures in Mobile Networks and their Relationships to Prices. Final Report for the European Commission by Europe Economics, 28 November 2001

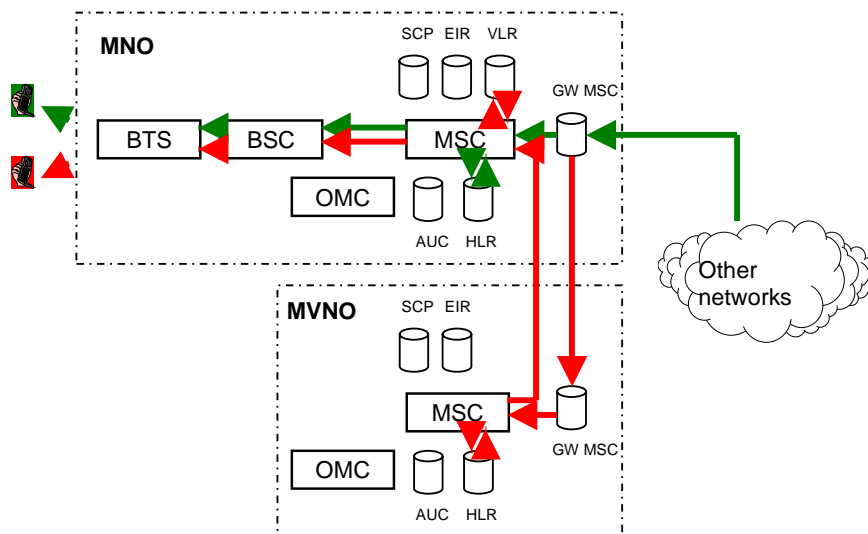


Figure 6. Call termination to "MVNO"s subscriber via the gateway-MSC of the hosting MNO and "MVNO"s MSC.

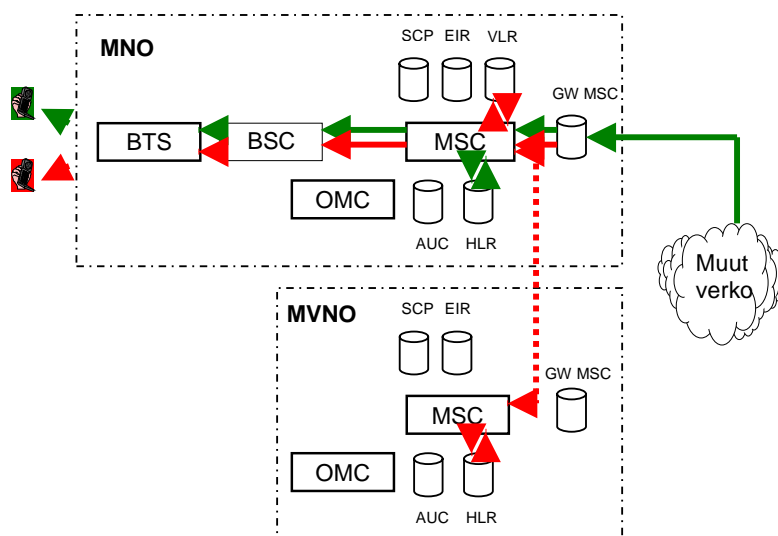


Figure 7. Call termination to "MVNO"s subscriber via the MSC of the hosting MNO.

4.2 Internal (on-net) traffic of MVNO

MVNO's internal, on-net traffic can be routed in two alternative ways: 1) switching the call in the MVNO's mobile switch MSC or 2) switching the call in the switch of the MNO.

4.2.1 Switching the call in MVNO's switch

Call is routed from MVNO's subscriber via MNO's BTS, BSC and MSC to MVNO's MSC. Call is switched in the MVNO's MSC and routed then back to MVNO's other subscriber, figure 8.

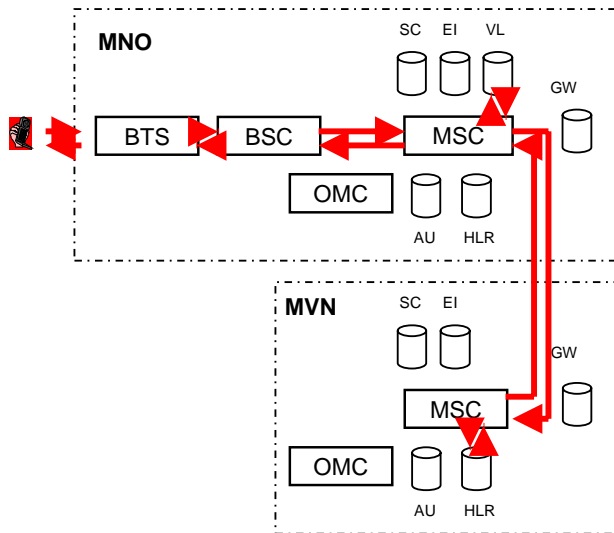


Figure 8. MVNO's internal call switched in its own MSC

According to the way the call is using the network components, the cost of MVNO's internal call is higher than the cost of an internal call of the hosting MNO due to overlapping use of MSC. The cost of MSC functions is marginal compared with costs of radio access, therefore difference in costs of internal calls of MNO and MVNO is not significant.

4.2.2 Switching the call in the switch of an MNO

MVNO's on-net call can be switched also in MNO's mobile switch. MVNO's own switch is updated by signalling, figure 9.

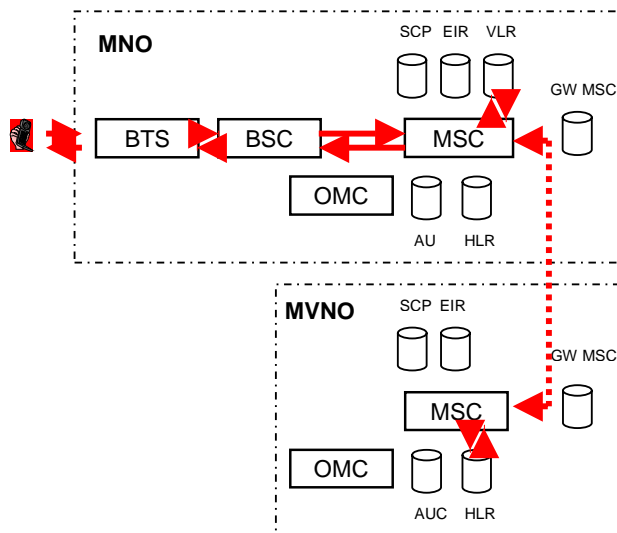


Figure 9. MVNO's internal traffic switched in MNO's switch

According to alternative in figure 9, the usability of MVNO's own value added services may be difficult.

4.3 Traffic between an MVNO and other network operators

4.3.1 Traffic between MVNO and its hosting MNO

Traffic between MVNO and its hosting MNO can take place in two alternative ways: 1) call is switched in the MVNO's mobile switch (call is routed via the point of interconnection) or 2) call is switched in the MSC of the hosting MNO (call is not routed via the point of interconnection).

4.3.1.1 Switching a call in the MSC of an MVNO

A call is routed through the point of interconnection between the MSCs of both the MNO and the MVNO, figure 10. This is a normal call conveyance procedure between two network operators. Termination charges are collected in both call directions, from MNO to MVNO and from MVNO to MNO.

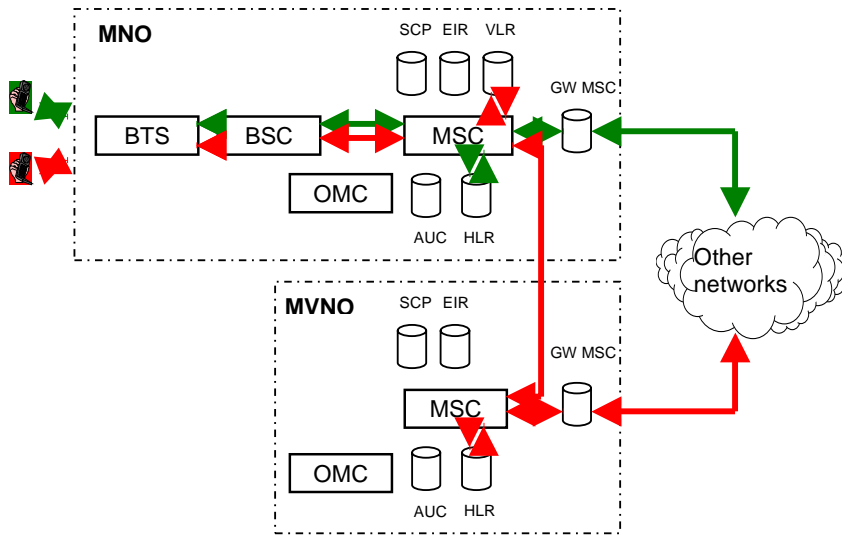


Figure 10. Call between MNO and its MVNO through their point of interconnection

The cost of a call is a cost of call origination of MNO (MVNO) plus a cost of call termination of MVNO (MNO) plus a transit cost between the two networks

4.3.1.2 Switching a call in the MSC of an MNO

In this alternative, a call is switched in the MSC of an MNO. It is not routed via the point of interconnection of the two networks, figure 11.

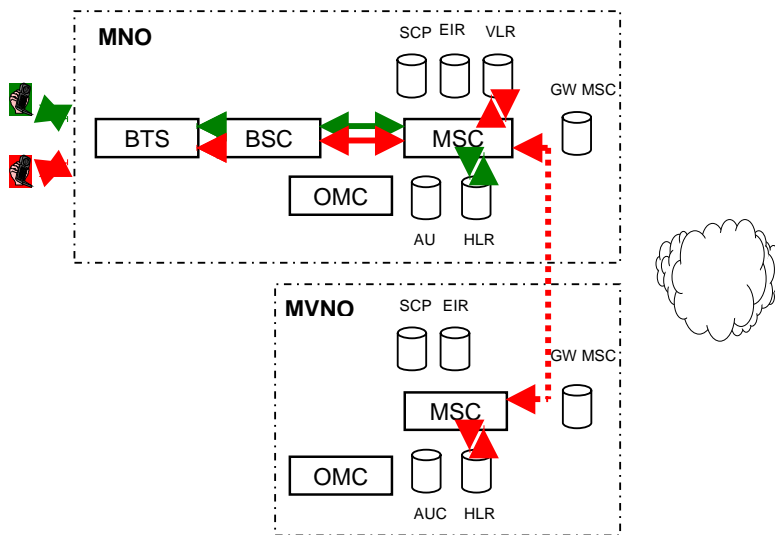


Figure 11. A call between MNO and its MVNO. Call is switched in the MSC of the MNO

In this alternative, call does not go through the point of interconnection and termination charges are not paid. The cost of a call corresponds approximately to the cost of an internal call of the MNO.

4.3.2 Traffic between MVNO and other MNOs

Traffic between MVNO and other mobile networks flows always via the point of interconnection of the networks. Referring to the alternative 2 in section 4.3.1.2, other mobile operators are in unequal position to MVNO and its hosting MVNO: in traffic between the MVNO and hosting MNO, no interconnection charge is collected, in traffic between MVNO and other mobile operators and in traffic between hosting MNO and other mobile operators, termination charges are collected, figure 12.

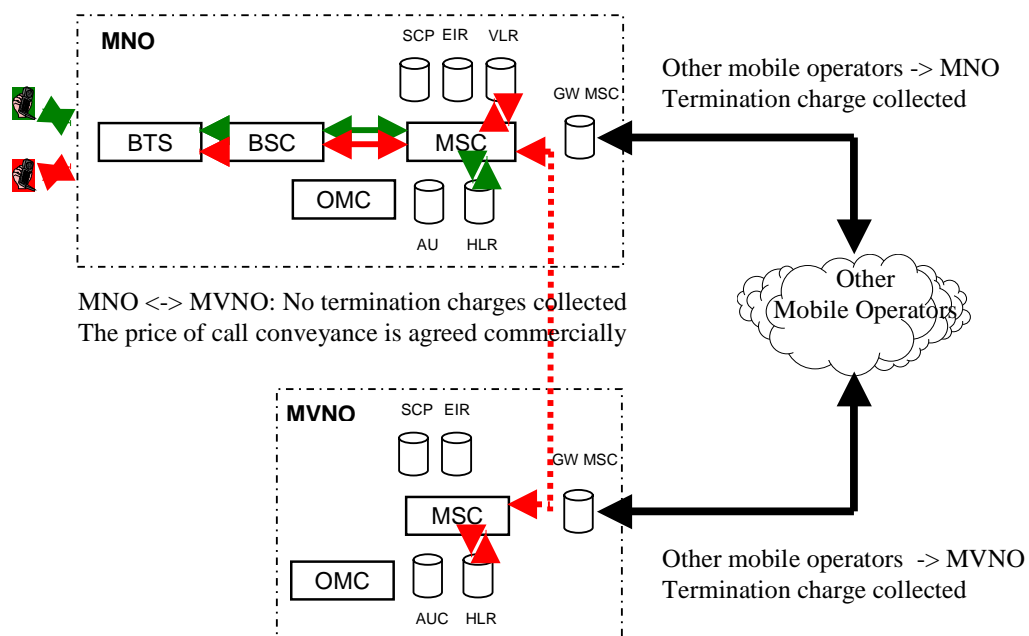


Figure 12. Traffic between MVNO/MNO and other mobile operators

4.4 International roaming

MVNO has its own SIM-card and its own HLR. It does not have a Visitor Location Register (VLR) of its own. Having its own SIM-card, MVNO can make only unilateral roaming agreements with international operators. Without its own VLR, it cannot offer international mobile operators to roam in the MVNO's network. Full mutual roaming agreements can take place only with the aid of a licensed mobile operator that has a VLR.

4.5 Impact of number portability to MVNO

In Finland, handling of ported numbers takes place in databases of service operators. From these databases, information regarding ported numbers is updated in the Master Database. From the Master Database, necessary routing information of ported numbers is

distributed to all network operators. As a network operator, MVNO has to have a database where routing information of ported numbers exist.

4.6 Impact of the changes of the Communication Market Act

A proposal of the Government for a change of the Communications Market Act ⁷ (available only in Finnish language) includes a change in the call termination practise. Before the change, an operator in the fixed network could not purchase call termination in the mobile network. In the new proposal, a mobile operator is obliged to sell call termination also to operators in the fixed network.

Change in the Act brings revenue losses to the mobile service providers. It does not necessarily increase total traffic minutes in the mobile networks. Losses in revenues create pressure to find out other sources of revenues. This may strengthen the competition in finding out new mobile service providers and create pressure in increasing tariff in the mobile networks.

The cost orientation of termination charge is important particularly in the traffic from fixed to mobile networks. If mobile termination charges are excess charged and they can be used to subsidize other mobile services, subscribers in the fixed network may pay part of the calls of mobile networks.

4.7 Conclusions

4.7.1 Costs of mobile services

The costs of traffic in mobile networks consists of 1) costs of call origination (call from the calling party to the point of interconnection), 2) costs of call terminations (call from the point of interconnection to the called party) and 3) cost of on-net traffic, (from the calling party to the called party in the same network).

1) Cost of call origination

An originating call flows from the calling party via BTS and BSC to MSC and from MSC to the point of interconnection. The total cost of call origination consists, therefore, of the costs of these network components and connected transmission links (ref 4.1.1). Regarding the use of network components, the cost of call origination is approximately the same as the cost of call termination. The cost of call origination can, however, be higher than the cost of call termination with reference to differences in call handling (for example handling of billing data of individual subscriber). Difference is marginal, based on the cost analysis where the cost of radio access (BTS, BSC and transmission paths) forms the bulk of the mobile costs⁸.

⁷ Hallituksen esitys Eduskunnalle laiksi viestintämarkkinalain muuttamisesta: Upl 622,

⁸ Cost Structures in Mobile Networks and their Relationships to Prices. Final Report for the European Commission by Europe Economics, 28 November 2001

2) Cost of call termination

Termination traffic flows from the point of interconnection to the MSC and from MSC via BSC and BTS and their transmission paths to the called subscriber (ref. 4.1.2). The cost of call termination relate to the usage of these network elements. The termination charges of mobile network operators which have been designated as operators with SMP, have to be cost-oriented. Termination charge can be different for different operators in cases when their termination costs differ from each other.

3) Cost of internal (on-net) traffic

When a mobile subscriber calls to another mobile subscriber within the same network, traffic will be routed first via BTS and BSC to the MSC and from MSC via BSC and BTS to another subscriber. Call utilises the same network elements than in call origination and call termination. Taking into account that the bulk of costs is born by the BTS, BSC and transmission links, the cost of on-net traffic is of magnitude the sum of costs of call origination and call termination.

Call origination, call termination and an on-net call use the same network components, BTS, BSC and MSC. It can be concluded that:

- The bulk of costs of mobile networks is born by BTS, BSC and transmission. The share of MSC and related equipment is of minor magnitude from total costs.
- The cost of call termination is of the same magnitude as the cost of call origination
- The cost of on-net call is of the same magnitude than the sum of costs of call origination and call termination.
- Regarding the costs of on-net traffic, no major differences exist between an MVNO and its hosting MNO

4.7.2 Non-discrimination and equal treatment regarding call termination

If MVNO and its hosting MNO are free to agree commercially the pricing of their mutual traffic (from MVNO to its hosting MNO and vice a versa), it sets other mobile operators in unequal position in relation to MVNO and its hosting MNO: No termination charges are collected in traffic between MVNO and its hosting MNO but termination charges are collected between other mobile operators and MVNO/its hosting MNO.

5 MVNO regulation

5.1 MVNO-activity in the context of the Communications Market Act

The operation of virtual network operators is not much dealt with in the Communications Market Act⁹. In accordance with the section 23 of the Act, MNOs can be imposed obligations regarding access to the MNO's network. The only reference to MVNO's can be found in the explanatory notes of the Act¹⁰:

⁹ Communications Market Act, 23.5.2003, definitions:

¹⁰ Hallituksen esitys Eduskunnalle viestintämarkkinoita koskevan lainsäädännön muuttamisesta. HE 112/2002 vp

23 §. Obligation to relinquish access right to a mobile network

According to subsection 1, the Finnish Communications Regulatory Authority may, by decision based on section 18, impose a network operator having SMP, an obligation to relinquish an access right for a service operator to the network of a mobile operator. The obligation imposed to the network operator gives the service operator the right to offer mobile services in the network of the obliged network operator. A service operator has, in accordance with the subsection 2, and in cases specified in subsection 1, to open and close mobile networks subscriber connections itself and the right to independent control over the associated customer relationships. With this respect, the regulation corresponds with the section 5, subsection 2 of the current Decision on Interconnection by the Ministry of Transport and Communication and enables so called service operator activity. In service operator activity, a service operator sells mobile services in the network of a network operator, by using subscriber card of the network operator (for example GSM.-network's SIM-card). The usage of a SIM-card of another operator limits the possibilities of the service operator for its own product development and the scope of its own service portfolio. Service operator has no choice but be content with the service alternatives and service implementation of the network operator. In the service operator activity, service operator is not able to utilise its own possible local networks.

In the so called virtual operator activity, service operator utilises, instead of the Home Location Register (HLR) of the network operator, its own HLR for the provision of its mobile services. By doing so, a virtual operator has possibilities of wider scope than normal service provider to offer end users its own services.

The proposed section enables also virtual operator activity and with this regard clarifies the current legislation. A service operator would have, based on this section, the right to define the scope of its access right and connect its own network elements to the network of the network operator.

Regarding roaming, subsection 3 refers to sections 36 and 37 where roaming is regulated in more detail. According to subsection 3, the obligation of section 23 to relinquish the access right does not concern national roaming, where service operator uses its own subscriber card and offers services in the first hand in its own network and utilises roaming only in the areas, which are not covered by its own network. An essential difference between roaming and service operator activity is the fact that in roaming, both parties act as network operators while in service operator activity, only the entity relinquishing the right of access is a network operator.

Regulation implements the Article 8 of the Access Directive. Proposed section 23 corresponds with paragraphs a) and e) in the list of examples in Article 12.1. of the Access Directive.

Based on the explanatory notes of section 23 of the Act, a virtual operator has been understood as a service operator, which would have right to define the scope of access and connect its own network elements in the network of the network operator.

Section 23 of the Act defines only obligations which can be given to a mobile network operator when necessary. This obligation is to give service operators the right for access to the network of the mobile network operator. Based on the wording of the Act, the

Finnish Communications Regulatory Authority has no power to set obligations to MNOs to give right for access to virtual *network operators*.

The Act does not prohibit, however, mobile network operators from leasing radio access to mobile virtual network operators as defined in this report. The Act does not therefore represent any restrictions to volunteer opening of virtual network activity.

5.2 The power of the Regulator

The Communications Market Act ¹¹ gives the Regulator power of wide scope to regulate the market by carrying out market analysis of relevant wholesale and retail markets at regular intervals and declare by its decision an operator to be an operator with Significant Market Power if, on the basis of market analysis, it is seen in a particular market to exert economic influence, alone or with others, that allows it to operate, to a considerable extent, independently of competitors, consumers or other users (Section 17 of the Act).

If an operator has been defined as an operator with SMP, the Regulator shall impose obligations that are needed to eliminate barriers to competition or to promote competition. The obligations shall be in correct proportion to the aim being addressed (Section 18 of the Act). In imposing an obligation, the following in particular shall be taken into account inter alia:

- relinquish access rights to a mobile network as laid down in section 23
- ensure cost-oriented and non-discriminatory pricing as laid down in section 37; According to section 37, the Regulator may impose an obligation on a telecommunications operator to specify the prices to be charged for relinquishing access rights, roaming or interconnection in such a way as to ensure that the prices are either cost-oriented or non-discriminatory or cost-oriented and non-discriminatory as referred to in section 84, and that it shall otherwise apply non-discriminatory terms. The Regulator may impose the pricing obligation referred to in subsection 1 of section 37 on a telecommunications operator with significant market power even if no obligation concerning interconnection or relinquishing access rights is imposed on the operator.
- join a communications network to another communications network as laid down in section 39;
- use cost-accounting procedures as laid down in section 87;
- separate its activities as laid down in section 89.

Obligations can be set also on other telecommunications operators. These are inter alia:

- to ensure cost-oriented and non-discriminatory pricing as laid down in section 37;
- to join a communications network to another communications network as laid down in section 39.

¹¹ Communications Market Act 23-5-2003

For operators operating in the retail markets, the Regulator has power to set specific obligations as defined in section 20 of the Act, if it finds out, based on the market analysis that:

- no competition exists in that defined retail market
- that the obligations referred to in section 18 imposed on an operator with significant market power in the wholesale market do not sufficiently promote competition in the retail market

Obligations to be set to mobile operators shall be based on the market analysis. In this respect MNOs and MVNOs do not differ from each other. The Regulator has power, if found appropriate, to set also MVNOs as operators with SMP and set them obligations as defined in the Communications Market Act.

6 The Finnish Telecommunications Mobile Market

6.1 Market development

The Finnish GSM market has developed through Telia Sonera (former Telecom Finland) and Elisa (former Radiolinja) duopoly to current environment where three country wide second generation mobile networks exist and several service providers provide their services in these networks. Service providers are partly tied by ownership with their hosting networks. Some mobile virtual network operators exist also, which act as independent network operators and utilise only the radio path of the licensed mobile network operator for their call origination and call termination.

Services market developed significantly after implementation of number portability in the Finnish mobile networks in 2003. In addition to number portability, price competition began by some market promotions which brought free on-net calls to the market.

From the view point of mobile network operators, free network capacity is available to be sold to service providers and MVNOs. When a mobile network operator has free capacity, its pricing is not strictly tied with cost structures of the network. Capacity exists already. No additional expansion or additional investments are needed. Excess capacity may sometimes be better to be sold out at a low price than leave it unsold. This offers a competitive advantage to operators which have excess capacity. When a service provider is forced to use a SIM-card of the hosting network operator, change of SIM-card forms a threshold to change the hosting network operator. An MVNO has a SIM-card of its own. Changing the hosting network operator does not entail changing of the SIM-card. Therefore the threshold for changing a hosting network operator is significantly smaller.

6.2 Market shares

6.2.1 Network Operators' view point

Market shares of subscribers connected to the networks of the Finnish network operators are shown in table 1.

Network operator	Subscriptions (1000) 1)	Market shares of subscriptions %	Service providers and MVNOs
TeliaSonera	2 882	59	Sonera, Saunalahti, ACN, Globetel
Elisa	1 369	28	Elisa, Tele2, MTV3, Cubio, Song
Finnet networks	640	13	DNA, Fujitsu, PG Free
Total	4 891	100	

1) subscriptions in Q3/2004 except Finnet-networks Q2/2004

Table 1. Subscriptions and market shares in Finnish mobile networks as of Q3/2004

The market share of TeliaSonera is nearly 60%, Elisa's about 28% and Finnet Networks about 13%. Service providers and MVNOs in TeliaSonera's network are: Sonera, Saunalahti, ACN ja Globetel, in Elisa's network Elisa, Tele2, MTV3, Cubio and Song. In Finnet Networks service providers are DNA, Fujitsu and PG Free.

6.2.2 Service Providers' point of view

Subscriptions and market shares of the Finnish Service Providers and MVNOs are shown in table 2.

	Subscriptions (1000) 1)	Subscription Market share %	Subscriptions in the fixed network, estimate
Sonera	2 264 000	46	760 000
Elisa	1 368 515	28	900 000
DNA	n. 640 000	13	800 000
Saunalahti	371 252	8	
Tele 2 + others	n. 250 000	5	
Total	n. 4 891 000	100	2 700 000
MNO total	4 272 515	87	
SPs and MVNOs	621 252	13	

1) Subscriptions in Q3/2004 except Finnet Networks (ref. DNA) 2Q/2004, Tele 2 + other are estimates

Table 2. Subscriptions and market shares of the Finnish mobile Service Providers and MVNOs Q3/2004

The market share of independent Service Providers and MVNOs was about 13% in the third quarter of 2004.

TeliaSonera is an overwhelming market leader in network provisioning. It is the biggest also in Service Provisioning, but its market share has fallen from 59% (networks) to 46% (services). Sonera has succeeded in contracts with independent service providers.

6.3 Comparison of wholesale and retail prices

The impact of price regulation to pricing of mobile services can be studied by comparing 1) regulated and unregulated prices with each other and 2) prices to costs involved. Comparison is important particularly in the case when it is evident that competition in

retail prices is attained on the expense of wholesale prices (for example: retail prices are less than wholesale prices).

Retail prices of service providers and MVNOs have been studied in an excel-sheet "Retail and wholesale tariffs". Figures do not include VAT. Retail prices of Service Providers were listed by the type of subscription such as they were in November 2004. Regarding wholesale prices, the only available price was the regulated price of call termination. Other wholesale prices are not public and they were not available for this study.

Price comparison is difficult. Price paid by the caller consists of several different component (subscription fee, monthly fee, call fee), which are different to different type of subscriptions. Furthermore, retail prices may occasional be promotional prices in order to accelerate the entry in the market. These prices can be below their costs. On the other hand, prices of conventional operators are more stable, although market competition may create new types of subscriptions and new promotional prices. The price analysis presented here is only suggestive. More explicit analysis would need more information about traffic distribution of different types of subscriptions, impact of monthly fees to call fees and more information on confidential wholesale prices and on real costs of services.

6.3.1 Impact of monthly fees to call charges

Call prices cannot be studied without taking into account other prices paid by the caller which are, in addition to call charges, subscription fees and monthly fees. Subscription fees are once-off fees. The aim of those fees is to cover costs of the establishment of the connection. Their impact to call charges is marginal in the long run. Monthly fee has more significant impact to call charges. In the relation of monthly fee and call charges two extremes exist: 1) monthly fee covers all call charges (no call charges are collected) and 2) call charges cover monthly charges (no monthly charge is collected).

In table 3, monthly fees of operators are compared with the so called ARPU figures (Average Revenue Per Unit), published by each operator. ARPU figure tells average revenue per subscriber. Comparing the monthly fee and ARPU-figure we can see the share of monthly fee from average revenue per unit. The procedure of ARPU calculation is not explicitly defined. Therefore, ARPU-figures published by different operators, are not necessarily directly comparable with each other. The analysis is made more difficult by the fact that ARPU-figure also includes the share of terminating traffic. However, analysis gives a view of the relationship between monthly fees and call charges.

	Subscription fee €	Monthly fee €	ARPU €	Monthly fee /ARPU %
Sonera	4,11	1,99 – 9,99	38,2	5,2 – 26,1
Elisa	7,89	3,33 – 6,1	37,5	8,9 – 16,3
DNA	2,9	0 – 7,93	n.a.	n.a.
Saunalahti	0 - 10	0 – 5,95 – (19,90) ²⁾	30,0 ¹⁾	0 – 19,8 - (66,3)

Figures include VAT. ARPU-figures from: Q2/2003

¹⁾ figure does not include terminating traffic from other mobile operators

²⁾ figure is not directly comparable. Includes speech time 450 min per month

Table 3. The share of monthly fee compared to average revenue per subscriber

The share of monthly fee of an average revenue per unit varies between 0 – 26%.

6.3.2 The share of call origination

6.3.2.1 Calls from mobile to fixed networks

If termination charge of the fixed network is deducted from the retail price (VAT excluded) of a call from mobile to fixed, the remainder demonstrates the share which is left to the mobile operator for call origination. This share is a common share of both the service operator and the network operator. In the excel sheet "Retail and wholesale tariffs" this share is compared with the mobile operators own termination charge. Termination charge is regulated and it should be cost-oriented. The comparison results in the difference in revenues of call origination and call termination. Details of comparison is shown in table 4.

Mobile operator	Retail price VAT excl. Euro cents	Termination charge of the fixed network ¹⁾	Call origination in the mobile network Euro cents	Call termination in the mobile network Euro cents
Sonera	7,30 – 13,90	2,3	5 – 11,60	9
Elisa	8,93 – 13,93 - 21,31 ²⁾	2,3	6,63 – 11,63 19,01	10
DNA	5,66 – 14,75	2,3	3,36 – 12,45	11
Saunalahti	6,5 – 12,3 ³⁾	2,3	4,2 – 10	9 ⁴⁾

All figures in Euro cents.

¹⁾ Estimate: local termination 1,6 € cents/min + transit fee 0,7 € cents/min.

²⁾ Price 21,31 only in one subscription type

³⁾ Saunalahti Lanka: Price 8,2 € cents + 0,82 € cents/min is significantly cheaper in long calls than the lowest price shown in the table

⁴⁾ Termination charge of the hosting MNO (Sonera) used in the table

Table 4. Revenue of call origination in traffic from mobile to fixed network

In all mobile operators, the share of call origination in the traffic from mobile to fixed network is mostly smaller than the termination charge of the same network. Taking into account that the total share of call origination includes shares of both service operator and network operator, the difference is even more significant (termination charge is a charge

of network operator only). When comparing the costs call conveyance, originating call uses the same network components than the terminating call and their costs are approximately on the same level. For this reason it is likely that call termination is over charged and it subsidizes other mobile services.

6.3.2.2 Calls between mobile operators

Regarding a call from one mobile operator to another, a termination charge of another operator is deducted from the retail price (VAT exclusive) of the first operator. In each case, the termination charge of a mobile operator that represents the biggest market share has been chosen. After the deduction, the remainder is the total share of call origination of both service operator and network operator. In the excel sheet "Retail and wholesale tariffs" this remainder has been compared with the termination charge of the operator. Comparison is shown in table 5.

Mobile operator	Retail price VAT excluded	Transit share	Termination charge in the target network	Share of call origination	Termination charge in the own network
Sonera	7,30 – 13,93	?	10 ¹⁾	-2,7 – 3,93	9
Elisa	8,93 – 13,93 – 21,31 ²⁾	?	9 ³⁾	-0,1 – 4,93	10
DNA	5,66 – 14,75	?	9 ³⁾	-3,3 – 5,75	11
Saunalahti	6,5 – 12,3	?	10 ¹⁾	-3,5 – 2,3	9 ⁴⁾

All figures are in Euro cents.

1) In the calculations Elisa's termination charge is used (second biggest mobile operators)

2) Price 21,31 is valid only in one subscription type

3) In the calculations, Sonera's termination charge is used (biggest mobile operator)

4) In the table, termination charge of the hosting operator (Sonera) is used

Table 5. The revenue share of call origination in the traffic from one mobile operator to another mobile operator

According to table 5, in the traffic from one mobile operator to another mobile operator, the share of call origination is in almost all mobile operators smaller than half of their own call termination. In specific subscriptions, the share is even negative. It should be noted that the total share covers both shares of service operator and network operator. The share of only network operator is significantly smaller than the total share. In the calculations, the transit charge which is valid in the traffic between mobile operators has not been taken into account. This would decrease the share of call origination further.

It is likely that in the traffic from one mobile operator to another, termination charge subsidizes significantly other mobile charges.

6.3.2.3 Calls within the same mobile network (on-net calls)

In this traffic mode, retail price (VAT exclusive) is compared with the mobile operator's cost of an on-net call, which has been estimated on the basis of cost of call termination, see excel table "Retail and wholesale tariffs"). Results of this comparison are demonstrated in table 6.

Mobile operator	Retail price VAT excluded	Own termination charge	Cost of an on-net call (estimate based on call termination)	Reminder
Sonera	7,30 – 13,93	9	18	-10,7 - -4,07
Elisa	8,93 – 13,93	10	20	-11,07 - -5,07
DNA	1,64 – 14,75	11	22	-20,36 - -7,25
Saunalahti	3,3 – 11,4	9 ¹⁾	18	-14,7 - -6,6

¹⁾ Termination charge of the hosting mobile operator (Sonera) is used

Table 6. Comparison of retail price to the cost of an on-net call

In table 6, the retail price of an on-net call is in all subscription types smaller than the cost of a call. Cost of an on-net call is estimated as twice the termination cost (=termination charge). Retail price includes the shares of both service operator and network operator. In a heavy competition, it is likely that costs of service operator (i.e. marketing, sales promotion) are significant. The share left to network operator is the smaller the bigger is the share of service operator. It is likely that termination charge subsidizes significantly other mobile services.

6.3.3 Termination charges in EU- and ETA-countries

According to IRG's (Independent Regulators Group) analysis¹², termination charges in Finland are the third cheapest within 27 European countries, after Lithuania and Norway. Termination charges in Finland were 9,29 Euro cents/min, in Denmark 11,64 cents/min and in the UK 13,40 cents/min. The most expensive termination charge was in Switzerland, 22,41 cent/min.

6.4 The impact of price regulation to MNO and MVNO

In free competitive environment, pricing of services takes place under market conditions and prices do not necessarily reflect cost of a product. Product can be under or over priced. In mobile products, only the price of call termination is regulated and even this only for operators having defined as operators of SMP. Other prices are not regulated. In the following, impact of price regulation is shortly described for SPs, MNOs and MVNOs.

Mobile Service providers: Their retail prices are not regulated

Mobile Network Operators: Only price for call termination of SMP operators is regulated. According to section 6.3, regulation is failed and price for call termination has been used as a source of revenue and a means to subsidize other mobile services.

Prices for call origination and for on-net calls are not regulated. Regarding pricing of call origination, problems encountered with call termination exists also in call origination, particularly regarding calls to specific national number series. The Regulator defined in

¹² IRG MTR Snapshot – July 2004. <http://irgis.icp.pt/admin/attachs/388.pdf>

its decision¹³ TeliaSonera as an SMP operator regarding access and call origination. The Commission of European Communities considered that the presented evidence was not strong enough to conclude TeliaSonera having SMP in the market of access and call origination, and the decision was withdrawn.

Mobile Virtual Network Operators: Prices for call termination have not been regulated so far. The pricing mechanisms between MVNOs and MNOs differ from each other as follows:

For SMP operators, price for call termination is regulated as cost-oriented. Calculation of cost-oriented price is a very complicated process and a real cost-oriented price is almost impossible to calculate. All accounting mechanisms include, in addition to measured costs, variables which cannot be measured. They have to be estimated. These estimates are for example the division of costs and traffic to different services. Division is necessary because the same functions and the same network elements serve several different services. Other estimated variables are risk premiums, reasonable rate return on investments, depreciation mechanism in relation to techno-economical life of different network elements, efficiency of investments, costs of the network compared with costs of a competitive efficient network, division of operation and maintenance costs to different services. List could be continued. Cost calculation includes so many presumptions and so many estimated variables that result of the calculation does not necessarily reflect the real cost of call termination.

With operators of SMP, price for call termination is regulated but the radio access, as leased for the MVNO, is free from regulation. The leasing price for radio access is based on the mutual, commercial agreement between the MNO and the MVNO. For the MVNO, its price for call termination consists, therefore, of the unregulated cost paid for the radio access to the MNO plus the cost of its own MSC and related equipment. In practise, the cost of MVNO's call termination can be only half of the regulated "cost-oriented" price of the MNO, although the real termination costs of an MVNO is the same or slightly more than the termination cost of the MNO, as found out in section 4.1.2.

As said before, market price does not need to reflect the costs involved. The problem is not the price or cost itself but the fact that almost the same product (call termination and radio access) has two different prices: Regulated "cost-oriented" termination price and unregulated price for radio access. When unregulated "market" price is about half of the regulated "cost-oriented" price, there is a possibility for cross subsidy from regulated price to other mobile prices.

6.5 Conclusions

Exact price/cost analysis of mobile networks would need calculations, where retail prices, division of traffic, wholesale prices and costs of network elements were taken into account. However, the simplified calculation exercise presented in this report, demonstrates that strong evidence exists that 1) there is a significant price distortion

¹³ Päätös huomattavasta markkinavoimasta matkaviestiverkkoihin pääsyn ja matkaviestinverkoista nousevan liikenteen markkinoilla. Viestintävirasto 13.10.2004; 991/934/2003

between regulated “cost-oriented” termination price and unregulated prices and 2) termination charges are far from cost-oriented prices and therefore, in conflict with the requirements of the Communications Market Act.

It is evident that charges of terminated traffic are used as a significant source of revenue although its purpose is only to cover costs involved. This has led to use of equipment in the fixed network, by which the high fixed to mobile rates can be by-passed. Price distortion can be seen also from the procedures where some subscribers receive compensation from calls they receive. When comparing termination rates of mobile and fixed network with each other, we can see that termination rates in mobile network are from four to five times the termination rates in the fixed network. To such a high deviation no real reason can be found.

The situation is strange taking into account the fact that mobile termination rates in Finland are the third cheapest in Europe. If mobile termination rates are distorted and highly excess to costs involved in Finland, what might be the case in other European countries?

It is evident that it is not enough to calculate costs of call termination. Simultaneously with calculation of costs of call termination, also costs of call origination and costs of on-net calls should be calculated in order to find out their mutual relations.

7 The status of SP and MVNO in relation to MNO

7.1 An SP in relation to the MNO

A mobile service provider is able to provide MNO’s services and products and charge them, but it can also produce value added services of its own. For providing these services it needs an IN-platform and an MSC of its own. As long as the provision of services takes place within the network of the hosting MNO and uses interconnection links of the hosting MNO, operator remains as a service operator and the hosting MNO as a network operator. Network operators compete with wholesale network provision and service providers with retail service provision.

Network operators could limit the sale of call minutes to service providers amongst other things by pricing. However, market competition and demands for growth set by the owners of network operators have created pressures to sell out existing free network capacity. Also the economies of scale have to be taken into account. Without a reasonable amount of subscribers, small entities have difficulties in obtaining sufficient traffic in its network and a reasonable rate of return on its investments. The amount of traffic is highly dependent on the amount of callers. The growth driver is therefore the growth of subscribers. This leads to competition on service providers. Operators having significant amount of free capacity, have benefits in this competition: The growth of traffic does not need new investments. Operators having no extra reserves are in a weaker position in this respect.

In accordance with the Communications Market Act, the Regulator has the power to impose obligations to SMP MNOs, in order to force them to offer network capacity to service operators and set them price controls. Regarding the views of the CEC, defining the MNOs as SMP in access and call origination would need strong arguments. It is likely that competition between MNOs and growth demands of the owners of network operators create expanding offerings of network services voluntarily without legal obligations. However, missing possibility to price controls in access and call origination may create pricing problems similar to problems of pricing of call termination.

7.2 MVNO in relation to MNO

When a service operator has an MSC of its own, it is able to send and receive traffic from other networks. When this service operator connects its equipment to other networks, it becomes an MVNO. MVNO can ask competitive hosting offers from any MNO and it is able to change its hosting MNO. This can take place in two alternative ways: 1) MVNO has a contract with one hosting MNO or 2) MVNO has for the same service contracts with two or more hosting MNOs.

7.2.1 Agreement with one hosting MNO

MVNO can make an agreement with one hosting MNO. This is the most common practise at the moment, although Saunalahti has agreements both with TeliaSonera and Elisa. MNOs intend to make agreements exclusive. Before making final decisions on the hosting MNO, MVNO can ask offers from all available MNOs and make its decision based on offerings regarding service level, price, quality of service, reliability, geographical coverage etc.

Regarding MNOs, their participation in the contest is limited to their free network capacity. If supply (own network capacity) is less than demand (capacity requested by the MVNO), full size competition does not necessarily emerge. This can increase leasing prices and tie MVNO more tightly to the hosting MNO. If free capacity exists in several MNOs, full size competition may emerge. Ten percentage market share, for example, is a factor having a significant negotiation power. Hosting MNO does not necessarily want to give its MVNO to other MNO and competing MNO would likely to have this size MVNO to fill its free network capacity. Heavy competition may lead to a situation, where 10% market share is shared between two or more hosting MNOs. If this is the case, MVNO will have agreements with two or more hosting MNOs.

7.2.2 Agreement with two or more hosting MNOs

Circumstance where an MVNO has a hosting agreement with two or more MNOs, leads to a situation where MVNO becomes a superior mobile operator:

- The coverage of its network is the common coverage area of its all hosting MNOs
- MVNO can route calls to its subscribers via the route of least cost

No single network operator can do this. In order to compete with MVNOs, MNOs have to establish MVNOs of their own. The focus of competition will transfer from network and services competition to service competition only. Interest to network investments is

endangered. Geographical coverage of GSM-networks of today is nearly nationwide and too much emphasis on this issue may not be stressed. However, question arises, such as who will build infrastructure in less profitable areas where network does not exist yet.

The fact that an MVNO could force MNO's radio access under competition, does not necessarily lead to changes in pricing of call termination in mobile networks. Both MNOs and MVNOs would still remain in a monopoly situation on mobile termination. They do not have natural interest to channel possible savings in termination costs to prices of call termination.

7.3 MVNOs in 3G networks

The impact of MVNOs in 3G networks has not been studied in more detail here. It is to be noted, however, that if MVNOs are able to make agreements with several 3G MNOs, it can lead to situation, where the focus of competition transfer from network competition to service competition. This may have an impact to investments in 3G networks.

8 International comparison

8.1 Ireland

8.1.1 Mobile market

In the three Irish GSM-networks there are about 3,5 million subscribers. Mobile operators are: Vodafone (market share of subscriptions about 54%), O2 (40%) ja Meteor (6%). The share of prepaid subscriptions is about 74%. In addition to GSM networks, one UMTS license has been issued for "3".

8.1.2 Regulation

ComReg has by its decision on 29.7.2004, defined Vodafone, O2, Meteor ja "3" as operators with SMP. ComReg proposes these operators the following SMP obligations:

- Obligation of Transparency
- Obligation of Non-discrimination
- Obligation of accounting separation
- Price control and cost accounting obligations

Proposals are under consultation. No final decision exists yet. MVNOs are not explicitly regulated. However, in the license conditions of 3G networks, an obligation to offer network services to MVNOs exists.

8.1.3 Mobile Virtual Network Operators

In Ireland, no MVNOs exist so far.

8.2 Sweden

8.2.1 Mobile market

Market shares of Swedish GSM subscriptions are as in table 7¹⁴.

Mobile operator	Status	Subscriptions (1000)	Market share %
TeliaSonera	MNO	3706	43
Tele2	MNO	3256	38
Optimal Telecom 1)	SP	84	1
Vodafone	MNO	1333	15
SPs + MVNOs 2)	SP + MVNO	290	3,3
Total		8669	100
MNOs total		8295	95,7
SPs + MVNOs total		374	4,3

1) Subsidiary of Tele 2

2) SPs include those operators which lease network capacity from network operators and which resell it to end users by its own name. Figure includes subscriptions of 3G operators "3".

Table 7. Market shares of mobile subscriptions in Sweden

In Sweden, the number of SPs/MVNOs is about 16. The only MVNO is Telenor, which sells its services under name "Djuice". Telenor Mobile provides its services in the hosting mobile network of Tele 2. The market share of Djuice is about 1% of Swedish mobile subscriptions.

8.2.2 Regulation

By its decision ¹⁵, PTS has defined mobile operators TeliaSonera, Tele2, Vodafone, Hi3G ja Telenor Mobile Sverige as operators with SMP on the market of call termination. SMP obligations have been defined as follows¹⁶:

TeliaSonera, Tele2 ja Vodafone:

- Requirement to provide network access on reasonable request, interconnection obligation
- Obligation relating to transparency
- Requirement not to unduly discriminate
- Accounting separation obligation
- Obligation concerning pricing and cost accounting procedures: Cost orientation LRIC

Telenor Mobile:

¹⁴ Svensk Telemarknad 2003; Marknadsdata – Mobila tjänster: Källa Post och Telestyrelsen, 9 juni 2004

¹⁵ Post och Telestyrelsen, Beslut, 6.7.2004, Diarie nr. 04-7287/23,a; 04-7228/23,a; 04-6952/23,a

¹⁶ Post och Telestyrelsen, Beslut, 6.7.2004, TeliaSonera, Tele2, Vodafone, Diarie nr. 04-6952/23,b
Post och Telestyrelsen, Beslut, 6.7.2004, Telenor Mobile, Diarie nr. 04-7228/23,b
Post och Telestyrelsen, Beslut, 6.7.2004, Hi3G, Diarie nr. 04-7287/23,b

- Requirement to provide network access on reasonable request, interconnection obligation
- Obligation relating to transparency
- Requirement not to unduly discriminate
- Accounting separation obligation
- Obligation concerning pricing and cost accounting procedures: Fair and reasonable prices

Hi3G:

- Requirement to provide network access on reasonable request, interconnection obligation
- Obligation relating to transparency
- Requirement not to unduly discriminate
- Accounting separation obligation
- Obligation concerning pricing and cost accounting procedures: Fair and reasonable prices

PTS would prefer the principle of termination charge reciprocity, i.e. parties would use the same interconnection prices. This is not an obligation of regulation, although reciprocity may result in mutual agreements of operators.

8.2.3 Mobile Virtual Network Operators

Djuice, owned by Telenor Mobile is the only MVNO in the Swedish mobile market. Its market share is about 1% of the Swedish mobile subscriptions.

In Sweden, the combined market share of SPs and MVNOs is about 3% of all mobile subscriptions. No further issues have emerged which would give reason for further regulation in addition to current SMP regulation.

8.2.4 Termination charges

Current (November 2004) Swedish termination charges are listed in table 8.

	Day time, Euro cents/min	Evening, Euro cents/min
TeliaSonera	9,1	9,1
Tele2	13,4	13,4
Vodafone	21,2	9,8
Telenor Mobile	10,8	10,8
Hi3G	21,2	10,0

Oanda converter 11.12.2004: 1SKR = 0,11147 Euro

Table 8. Swedish termination charges as of November 2004

Termination charges vary significantly. It is likely that TeliaSonera's termination charges are LRIC-based. LRIC-based pricing entered into force in summer 2004 also to other SMP operators. It is to be noted that Telenor Mobile's termination charge is 18,6% more

than the corresponding charges of TeliaSonera but clearly below the charge of its hosting MNO, Tele2.

8.3 Denmark

8.3.1 Mobile market

By the end of the year 2003 there was 4,868,921 mobile subscriptions in Denmark¹⁷:

Mobile operator	Status	Subscriptions (1000)	Market share %
TDC	MNO	1574132	32
Sonofon	MNO	1027940	21
Orange	MNO	612420	13
Telmore	SP1) (TDC)	502566	10
Telia	MNO	463672	10
Debitel	SP (TDC)	303294	6
CBB Mobil	SP2) (Sonofon)	184238	4
3	MNO	50359	1
Others	SPt + MVNOt	150301	3
Total		4868921	100
MNOs total		3678164	76
SPs + MVNOs		1190757	24

Table 9. Mobile subscription market share in Denmark at the end of 2003

In Denmark, SMP operators have been imposed an obligation to offer network services to SPs and MVNOs.

Based on a presentation¹⁸ strong SPs have entered into Danish mobile market. Those SPs offer mobile services in significantly cheaper price than conventional SPs. Their operation is based on the use of Internet as a marketing channel. A customer can register him/herself via Internet and receive his/her SIM-card by mail. Billing takes place via Internet or SMS.

According to the presentation, nice priced service providers have gained 23% market share in mobile calls and almost 30% market share in SMS. Biggest SPs, Telmore and CBB Mobil have caught up 43,7% of all new subscriptions from 2001 to 2Q/2003. It is to be noted however, that Telmore and CBB are not independent service providers. Telmore is owned by TDC and CBB Mobile is owned by Sonofon. Sonofon bought CBB Mobile in 2003.

The success of nice priced SPs can be seen from the Telmore figures: In 3Q/2003 it provided about 40% of all Dankort&Visa/Dankort Internet transactions.

As a consequence of nice price SPs:

¹⁷ Telestatistik – 1. halvår 2004; IT og Telestyrelsen

¹⁸ ITU Asia 2004: Will discount operators kill MNOs?

- The price of a mobile call has decreased about 50% during 2004 and was on the level of 9 Euro cents/min (incl VAT) in the end of 2004
- The price of SMS has fallen from 7 Euro cents to 3 Euro cents
- Subscription fee has fallen from 6,7 Euros to zero

8.3.2 Regulation

ITST (IT og Telestyrelsen) has carried out a market analysis regarding markets 15 (mobile access and call origination) and 16 (mobile call termination) and released them for consultation¹⁹, ²⁰. It is the view of the ITST that in the market of access and call origination competition takes place and no SMP obligations are needed. However, in the market of mobile call termination, no competition exists and mobile operators TDC, Sonofon, Telia, Tele2, Orange and "3" should be defined as SMP operators in the market of call termination. Final decision does not exist until the end of 2004.

8.3.3 Mobile Virtual Network Operators

In Denmark only one MVNO exists, Tele 2. Its market share is less than 3% of total mobile subscriptions of Denmark.

8.3.4 Termination charges

Termination charges in Denmark in the end of 2004 are presented in table 10.

Mobile Operator	Day time, Euro cents/min	Evening time Euro cents/min
TDC	14,5	7,3
Sonofon	13,5	8,9
Telia	14,5	7,3
Orange	14,5	7,3
Hi3G	16,2	8,9
Tele2	14,5	7,3

Oanda Converter 11.12.2004: 1 DKr = 0,13462 Euro

Table 10. Danish mobile termination charges at the end of 2004

Tele 2, which is the only MVNO in Denmark, operates in the hosting network of Sonofon. During day time, Tele 2's termination charge is more than its hosting MNO but during evening time less than its hosting MNO. It is to be noted that prices in table 10 are listed charges. They may change to reciprocal prices in mutual negotiations.

¹⁹ Analyser om reel konkurrence på engrosmarkedet for mobilaccess (marked nr. 15). IT og Telestyrelsen. Udkast 18 november 2004

²⁰ Analyser om reel konkurrence og SMP på engrosmarkeder for mobilterminering (marked nr. 16). IT og Telestyrelsen, Udkast 28 september 2004

8.4 The UK

8.4.1 Mobile market

In the UK, the number of mobile subscribers is about 57 million divided quite evenly to four mobile network operators: Vodafone, O2²¹, Orange and T-Mobile, each of them having from 13 to 15 million subscribers. Figures include subscriptions of SPs which operate in the networks of licensed operators. The market share of SP/MVNOs is about 13% of the total amount of subscribers. The biggest service provider is Virgin Mobile, which had 4,6 million subscribers and 8% market share in September 2004. Virgin Mobile operates in the network of T-Mobile. Regarding SP/MVNO market, Ofcom has not collected operator specific market information. Ofcom considers that in the SP/MVNO market, competition exists, therefore no need for special market supervision has been found. In 2003, Vodafone bought the biggest remaining SP, including Singlepoint, which at that time had over 1 million subscribers. In November 2004 the British Telecom (BT) started as an MVNO in Vodafone's network. At the moment, BT has about 300 000 subscribers.

8.4.2 Regulation

Ofcom has defined all four licensed mobile operators, T-Mobil, Vodafone, Orange, O2, Inquam ja "3" as operators with SMP²².

SMP obligations differ from operator to operator as follows:

T-Mobile, Vodafone, Orange ja O2:

- provide network access (i.e. 2G call termination) on reasonable request;
- do not unduly discriminate in relations to matters connected with such network access;
- supply to Ofcom copies of any new or amended access contracts;
- give advance notification of price changes; and
- reduce termination charges in line with charge controls.

Inquam:

- a requirement that it gives advance notification of price changes.

"3"

- a requirement that it gives advance notification of price changes and
- supplies to Ofcom details of call volumes.

Ofcom has also decided that no ex-ante regulations are imposed to termination in 3G networks. Regarding 2G-termination, price control for T-Mobile, Vodafone, Orange and O2 is in force until 2006.

²¹ Former BT Wireless and BT Cellnet, who merged into an independent company and got name mmO2. In 2002 the name was changed to O2 and BT Cellnet became O2 UK Ltd. mmO2 is a stock exchange company. The biggest shareholder owns less than 6% of company's shares.

²² Wholesale Mobile Voice Call Termination, Ofcom, Statement, 1 June 2004

8.4.3 Mobile Virtual Network Operators

The abbreviation MVNO is used in the mobile market of the UK, but those MVNOs are in practise SPs or ESPs, not virtual network operators as defined in this report. They operate in the networks of their hosting MNO and they do not have interconnection links of their own. Therefore, they have not defined their own termination charges and they do not pay termination charges in the traffic between the SP/ESP and the hosting MNO. For example, calls between Virgin Mobile and T-mobile are switched in the MSC of T-Mobile. Virgin Mobile is a stock exchange company. Ultimate decision power is used by the shareholders of Virgin Group after purchasing the shares of T-Mobile on 29.1.2004.

According to Ofcom, no restrictions exist which would limit SP's freedom to provide their services in more than one hosting MNO. The customers of BT have been connected to networks of O2 and T-Mobile but they will be transferred to Vodafone in the first half of 2005. No restrictions exist either for ESPs to make interconnection agreements with network operators but network operators have no legal obligation to do so.

Interconnection agreements can be based on commercial terms. SPs are not tied with one hosting MNO, although some limitations can be made based on the mutual agreements. When changing the hosting MNO, change of the SIM-card forms a threshold. No such SP is known which would aim into agreement with more than one hosting MNO.

8.4.4 Termination charges

Termination charges of the UK operators are shown in table 11.

	Day time Euro cents/min	Evening time Euro cents/min	Weekend Euro cents/min
Vodafone	13,8	2,3	1,8
O2	9,1	9,1	4,5
Orange	10,9	7,9	6,5
T-Mobile	12,6	5,8	5,8

Oanda converter, 11.12.2004: 1GBP = 1,44844 Euro

Table 11. Termination charges in the UK as of November 2004

8.5 USA

The US market and the position and pricing of the US MVNOs are not studied here in more detail. US market differ from the market in Europe. In Europe, a call is paid by the caller (CPP, Calling Party Pays), in the US, CPP is partly used but mostly MPP procedures is used (Mobile Party Pays). Table 12 shows MVNOs with their hosting MNOs, operating in the US market in February 2004²³.

²³ What is an MVNO? http://www.mobilein.com/what_is_a_mvno.htm

SP/MVNO	Hosting MNO
9278 Mobile	Sprint
Air Voice Wireless	AT&T
Boost Mobile	Nextel
Call Plus	AT&T
EZ Link Plus	Cingular
GSR Mobile	Sprint
Just Talk	AT&T
Liberty Wireless	Sprint
Locus Mobile	AT&T
Mobile PCS	Sprint
Omni Prepaid Cellular	Verizon
Page Plus	Verizon
STI Mobile	Sprint
TracFone	Verizon/Cingular

Table 12. “MVNO”s in the US market as of February 2004

Also MVNE-type operators exist such as: CSG Systems, Martin Dawes Group, Inphonic, ZTar Mobile

Most of MVNOs in table 12 are not real virtual network operators but ESP type service providers with their MSCs, SIM-cards and services. Competition in the mobile market has begun and new SPs and ESPs are entering the market with speed.

8.6 Conclusions

8.6.1 MNO-market

When MNO market is estimated by the number of subscriptions, some differences exist between reference countries: In the UK, all competing licensed mobile operators are of the same magnitude in size: each about 25% of the total market. In Sweden, TeliaSonera and Vodafone are of the same magnitude: TeliaSonera has 43% and Vodafone 38% market share. In Denmark, market share of TDC is 32% and Sonofon’s 21%, Orange 13% and Telia 10%.

In Finland differences in market shares are bigger. Sonera’s market share is 59%, Elisa’s 28% and Finnet Networks about 13%. Difference is smaller when considering market shares of service operators: Sonera’s market share is 46%, Elisa’s market share 28% and DNA’s market share about 13%. Sonera has succeeded in having most service providers in its network

8.6.2 MVNO-market

The Finnish MVNO market differs from other reference countries. In the UK and Ireland, no MVNOs exist. In Denmark and Sweden, each has only one MVNO but its market share is small. Differences can be seen in table 13.

Country	SP/MVNO market share (%)	MVNO market share
Finland	13	9
UK	13	-
Denmark	23	<3
Sweden	4	1

Table 13. SP/MVNO market shares in reference countries

8.6.3 Regulation

Regarding call termination, all MVNOs in the reference countries have been imposed SMP obligations. Obligations imposed to licensed network operators are stronger than obligations imposed to virtual network operators. In the UK, no MVNOs exist and an SMP obligation regarding price controls have been imposed to all licensed mobile operators. In Denmark, no final decision exist so far but it is proposed that all network operators, including MVNOs should be nominated as SMPs. Further details regarding the scope of obligations are still open. In Sweden, all mobile network operators, including MVNOs have been declared as having SMP. Obligations for pricing of call termination are lighter than obligations for licensed network operators. MVNOs do not have obligation for cost orientation but their termination charges have to be fair and reasonable.

8.6.4 Termination charges

Termination charges of reference countries are presented in table 14. In Finland, no distinction has been made between peak/off-peak charges. In Sweden peak/off-peak pricing has been used partly. In Denmark, peak/off-peak pricing is used by all network operators and the off-peak price is about half of the peak rate. In the UK, peak/off-peak pricing has been used, but pricing deviation between peak/off-peak prices is larger than in other reference countries.

Country	Mobile operator	Peak tariff	Off-peak tariff	
			Evening	weekend
Finland	Sonera	9	9	9
	Elisa	10	10	10
	Finnet Verkot	11	11	11
	Saunalahti			
UK	Vodafone	13,8	2,3	1,8
	O2	9,1	9,1	4,5
	Orange	10,9	7,9	6,5
	T-Mobile	12,6	5,8	5,8
Denmark	TDC	14,5	7,3	7,3
	Sonofon	13,5	8,9	8,9
	Telia	14,5	7,3	7,3
	Orange	14,5	7,3	7,3
	Hi3G	16,2	8,9	8,9
	Tele2	14,5	7,3	7,3
Sweden	TeliaSonera	9,1	9,1	9,1
	Tele2	13,4	13,4	13,4
	Vodafone	21,2	9,8	9,8
	Telenor Mobile	10,8	10,8	10,8
	Hi3G	21,1	10,0	10,0

All figures in the table are Euro cents/min

Table 14. Termination charges in reference countries

9 Conclusions

9.1 Definition of MVNO

In this report, an MVNO has been defined as an mobile network operator who routes calls independently within its network and whose network is connected to other networks and which has its own interconnection agreements with other network operators.

Communications Market Act does not define an MVNO. The only reference to MVNO is made in the explanatory notes for the section 23 of the Act, by which an MVNO is defined as a service operator, which uses the network of the hosting MNO.

Communications Market Act does not prohibit MVNOs being established as network operators.

There are significant operational and pricing differences between SPs, MNOs and MVNOs. If MVNO operation is allowed in the market, MVNOs should be defined in the Communications Market Act.

Conclusion 1.

The word MVNO is understood internationally in many different, often misleading ways. There are significant operational and pricing differences between mobile service providers, mobile virtual network operators and mobile network operators. Without a definition of a Mobile Virtual Network Operator, interpretation of the Communications Market Act and issuing new possible obligations for MVNOs is problematic. Definition of Mobile Virtual Network Operator should be included in the Communications Act.

9.2 Traffic between SPs, MVNOs and hosting MNO**Pricing of traffic between SPs and their hosting MNO**

A call between subscribers of an SP and an MNO is functionally and regarding costs the same as a call between subscribers of the hosting MNO or between subscribers of the service provider. Wholesale prices of on-net calls are not regulated. When calls do not flow through the point of interconnection, prices of calls between the service provider and the MNO can be agreed on commercial terms. This set competing SPs in unequal position: in calls between the SP and the hosting MNO, no termination charge is collected but in calls from other SPs to the MNO and its SP, termination charges are collected. This inequality is difficult to be removed: on-net call does not go through the point of interconnection. In addition, division between a reseller and competing, independent service provider is difficult to find out. In the first case, separation of calls between the reseller and the hosting MNO should not be done, in the latter case it maybe should be done for the sake of non-discrimination and equal treatment.

Traffic between MVNO and its hosting MNO

When an MVNO switches calls in its own mobile switch and it has its own interconnection agreement, relation between the MVNO and its hosting MNO is different compared to one between the Service Provider and the hosting MNO. For the MVNO, MNO acts only a lessor of the radio access for call origination and call termination from MVNO switch to MVNO's subscriber. MVNO routes its own calls by itself. MVNO acts, therefore, as an independent network operator, not only for its on-net calls but also for calls between the MVNO and its hosting MNO. Therefore, MNO should not switch and price those calls. Instead, those calls should be routed via the point of interconnection between the MVNO and MNO.

It is to be noted that in either case, the cost of a call is approximately the same. If pricing of call termination would be based on costs, the impact of routing mechanism would not necessarily be of importance.

Conclusion 2.

The hosting MNO is able to switch MVNO's on-net calls and calls between the MNO and the MVNO in its own mobile switch. No termination charges are paid. This sets other operators in unequal position with them. Other operators pay termination charges for calls to MVNO and to its hosting MNO. When an MVNO is in a position of independent network operator, traffic between the MVNO and its hosting MNO should be routed via their points of interconnection.

9.3 Regulation of MVNO's call termination

MVNO as an SMP operator

Regarding call termination, virtual network operator does not differ from other network operators. It is in a monopoly situation regarding call termination to its network. A call to MVNO's subscriber goes through its point of interconnection and prices for call termination are defined by the MVNO. With lacking competition in call termination, MVNO has no natural interest to reflect possible savings in increased efficiency or call conveyance to interconnection charges. Regarding SMP definition, therefore, MVNO's call termination should be analysed in a similar manner to that for licensed MNOs.

Obligation for cost orientation

Unlike licensed MNOs, the cost of call termination of an MVNO is more easily found out. The cost of MVNO's call termination consists of the cost of its MSC and related equipment added by the leasing cost of MNO's radio access. For finding out the latter cost, no major cost calculations are necessary: the cost is exactly the charge paid by the MVNO to the hosting MNO for radio access.

The unregulated, market-based charge of the radio access, can be even half of the termination charge of the MNO. In order to impose obligation of cost orientation for an MVNO, the MVNO cost-oriented termination charge could be near half of the regulated termination charge of its hosting MNO. This could lead to an intolerable situation for an MVNO. It could not use excess of termination charge to subsidize other mobile services but its hosting MNO could still be able to do so. When considering SMP obligations to MVNOs, attention should be paid on the consequences of cost-oriented pricing.

Conclusion 3.

Regarding call termination, an MVNO does not differ from MNOs. MVNO can be recognised as an SMP operator as well as any MNO.

Conclusion 4.

By imposing cost oriented termination pricing to MVNOs, its termination charge would be tied with market prices of radio access. It would take an MVNO in a difficult position compared with MNOs, whose regulated “cost oriented” termination charges are significantly higher than market oriented prices. When considering SMP obligations to MVNOs, special attention should be paid to the consequences of cost orientation of termination charges.

9.4 Pricing of MNO’s call termination

This report gives clear indication that MNO termination charges do not correspond with requirements of cost orientation. MNO’s regulated termination charge is something else than unregulated radio access which MNO’s sell to service providers/MVNOs in the form of call origination, call termination or on-net calls. Call origination uses the same network components as call termination and its cost is, therefore, of the same magnitude than call termination. Correspondingly, cost of a network internal call (on-net call) is of the same magnitude as the sum of call origination and call termination. This is seen in no way in commercial retail prices. A simplified price/cost analysis made in this report gives clear indication that call termination subsidize significantly other mobile services and therefore causes a significant price distortion. It may be seen exacerbating that retail prices are less than wholesale prices. Call termination has become a significant source of revenue to mobile operators although with SMP regulation this was just intended to be avoided.

It is to be noted, that termination charges in Finland are the third cheapest in Europe. If termination charges significantly subsidize other mobile services in Finland, what would be the situation in other European countries? Or is it so that call termination charges are cost-oriented and retail charges are significantly under cost?

In order to remove the pricing distortion, pricing should be tied to market prices in a manner or another or by other means to right relation with the costs and pricing of on-net calls.

Conclusion 5.

Pricing of call termination of SMP mobile operators does not base on the costs involved. The price paid for call termination is so high that it forms a significant source of revenue for mobile operators and it is used to subsidize other mobile services, although the objective of regulation of call termination has been just to prevent this. Pricing of mobile call termination should be tied to market prices in a manner or another or by other means to right relation with pricing and costs of on-net calls.

9.5 Impact of MVNOs to service and network competition

If an MVNO succeeds to make a leasing contract of radio access with two or several MNOs, it becomes a superior network operator. The coverage of its network is the combined coverage of its contracted networks, it can contest the radio path of all its contracted MNOs and route its traffic via the network which is the cheapest. No one MNO can do this alone. In order to be able to compete with MVNOs, MNOs have to establish their own MVNOs. The focus of competition will turn from service and network competition to service competition on the expense of network competition. It may lead to lessening of interest in network investments. In case of networks with nationwide coverage, this concern may not be very essential. A question arises, however, who builds the networks in the still remaining unprofitable areas? Regarding 3G networks, this concern may prove to be more relevant. Their coverage is still limited. MVNOs ability to make contracts with several MNOs simultaneously and its impact to service/network competition should be discussed in further detail.

Conclusion 6.

If an MVNO succeeds to make a contract for radio access with two or more MNOs, it becomes a superior mobile operator. In order to be able to compete with MVNOs, MNOs have to establish MVNOs of their own. This will change the competition focus from service and network competition to service competition only and lessen interests in network investments. The matter should be noted when considering conditions for services and network competition.

Glossary

Abbreviations used in the Report:

ARPU	Average Revenue Per Unit
AUC	Authentication Centre
BSC	Base Station Controller
BTS	Base Transceiver Station
ComReg	Commission for Communications Regulation, Ireland
EIR	Equipment Identity Register
ESP	Enhanced Service Provider
GW MSC	Gate Way Mobile Switching Centre
HLR	Home Location Register
IRG	Independent Regulators Group
ITST	IT og Telestyrelsen, Denmark
MNO	Mobile Network Operator
MSC	Mobile Switching Centre
MVNO	Mobile Virtual Network Operator
Ofcom	Office of Communications, The UK
OMC	Operations and Maintenance Centre
PTS	Post och Telestyrelsen, Sweden
SIM	Subscriber Identity Modul
SCP	Service Control Point
SMP	Significant Market Power
SMS	Short Message Service
SP	Service Provider
VLR	Visitor Location Register

Used terms:

Hosting MNO

Mobile Network Operator who has given the MVNO right to use its network to connect MVNO's subscribers to MVNO's MSC.

Call termination

Traffic from the point of interconnection to the connection point of the recipient subscriber.

Independent service provider

Service operator, which is not the same company with or subsidiary of the hosting network operator, and who does not have other close ties with the hosting network operator.

Charging of Mobile services in Finland, 11/2004

Sonera 11/2004 Prices VAT excl	Install Euro	Monthly Euro	Mob-to-fixed cents/min	Fixe termin cents/min 5)	Sonera's share cents/min	To other mobiles cents/min	Term. Elisa cents/min	Sonera's share cents/min	On-net call cents/min	Sonera's term.	Sonera's share of access	From fixed network Peak Off-peak	Sonera's own term.	Sonera's service share
One	3,3689	3,27	10,66	2,3	8,36	10,66	10	0,66	10,66	9	1,66	19,7 13,1	9	4,1-10,7
Max	3,3689	5,73	7,30	2,3	5,00	7,30	10	-2,70	7,30	9	-1,70	19,7 13,1	9	4,1-10,7
Mini	3,3689	1,63	13,93	2,3	11,63	13,93	10	3,93	13,93	9	4,93	19,7 13,1	9	4,1-10,7
Classic Duo	3,3689	2,87	9,84	2,3	7,54	9,84	10	-0,16	9,84	9	0,84	19,7 13,1	9	4,1-10,7
Privat Duo	3,3689	3,00	12,30	2,3	10,00	12,30	10	2,30	8,20	9	-0,80	19,7 13,1	9	4,1-10,7
			12,30	2,3	10,00	12,30	10	2,30	12,30	9	3,30	19,7 13,1	9	4,1-10,7
			8,20	2,3	5,90	8,20	10	-1,80	8,20	9	-0,80	19,7 13,1	9	4,1-10,7
Zeroforty	3,3689	8,19	10,66	2,3	8,36	10,66	10	0,66	10,66	9	1,66	19,7 13,1	9	4,1-10,7

Elisa 11/2004 Prices VAT excl	Install Euro	Monthly Euro	Mob-to-fixed cents/min	Fixe termin cents/min 5)	Elisa's share cents/min	To other mobiles cents/min	Term. Sonera cents/min	Elisa's share cents/min	On-net call cents/min	Elisa's term.	Elisa's share of access	From fixed network Peak Off-peak	Elisa's own term.	Elisa's service share
Tandem	6,47	4,00	21,31	2,3	19,01	21,31	9	12,31	9,84	10	-0,16	21,3 13,9	10	3,9-11,3
			9,84	2,3	7,54	13,93	9	4,93	9,84	10	-0,16	21,3 13,9	10	3,9-11,3
Tandem Aina	6,47	2,73	13,93	2,3	11,63	13,93	9	4,93	13,93	10	3,93	21,3 13,9	10	3,9-11,3
Tandem Aina Plus	6,47	3,24	9,84	2,3	7,54	9,84	9	0,84	9,84	10	-0,16	21,3 13,9	10	3,9-11,3
Tandem Aina Tekst	6,47	4,06	12,70	2,3	10,40	12,70	9	3,70	12,70	10	2,70	21,3 13,9	10	3,9-11,3
Tandem Aina Yö	6,47	2,73	13,93	2,3	11,63	13,93	9	4,93	13,93	10	3,93	21,3 13,9	10	3,9-11,3
			13,93	2,3	11,63	13,93	9	4,93	0,00	10	-10,00	21,3 13,9	10	3,9-11,3
Eturinki	6,47	4,06	12,30	2,3	10,00	12,30	9	3,30	12,30	10	2,30	21,3 13,9	10	3,9-11,3
			8,20	2,3	5,90	8,20	9	-0,80	8,20	10	-1,80	21,3 13,9	10	3,9-11,3
Tandem Aina Pro	6,47	5,00	8,93	2,3	6,63	8,93	9	-0,07	8,93	10	-1,07	21,3 13,9	10	3,9-11,3

DNA 11/2004 Prices VAT excl	Install Euro	Monthly Euro	Mob-to-fixed cents/min	Fixe termin cents/min 5)	DNA's share cents/min	To other mobiles cents/min	Term. Sonera cents/min	DNA's share cents/min	On-net call cents/min	Finnet term.	DNA:n share of access	From fixed network Peak Off-peak	Finnet's own term.	DNA's service share
Yrityslitymä	2,4	4,0	9,84	2,3	7,54	13,93	9	4,93	9,84	11	-1,16	21,3 13,9	11,0	2,9-10,3
Koti GSM 1	2,4	6,5	10,66	2,3	8,36	10,66	9	1,66	5,74	11	-5,26	21,3 13,9	11,0	2,9-10,3
Onni	2,4	0,6	5,66	2,3	3,36	5,66	9	-3,34	5,66	11	-5,34	21,3 13,9	11,0	2,9-10,3
Helmi	2,4	2,4	7,38	2,3	5,08	7,38	9	-1,62	1,64	11	-9,36	21,3 13,9	11,0	2,9-10,3
Vakio S	2,4	0,0	14,75	2,3	12,45	14,75	9	5,75	14,75	11	3,75	21,3 13,9	11,0	2,9-10,3
Vakio M	2,4	3,2	9,84	2,3	7,54	9,84	9	0,84	9,84	11	-1,16	21,3 13,9	11,0	2,9-10,3
Vakio L	2,4	6,5	8,61	2,3	6,31	8,61	9	-0,39	8,61	11	-2,39	21,3 13,9	11,0	2,9-10,3
Prepaid	0,00	0,00	13,11	2,3	10,81	13,11	9	4,11	13,11	11	2,11	21,3 13,9	11,0	2,9-10,3

Saunalahti 11/04 Prices VAT excl	Install Euro	Monthly Euro	Mob-to-fixed cents/min	Fixe termin cents/min 5)	Saunalahti share cents/min	To other mobiles cents/min	Term. Elisa cents/min	Saunalahti share cents/min	On-net call cents/min	Saunal term.	Saunal share of access	From fixed network Peak Off-peak	Sonera's term.	Saunal service share
Tasahalpa	0,00	0,00	6,5	2,3	4,2	6,5	10	-3,5	6,5	9	-2,5	21,5 13,6	9	4,6-12,5
Simppele	0,00	0,77	7,7	2,3	5,4	7,7	10	-2,3	7,7	9	-1,3	21,5 13,6	9	4,6-12,5
Sopuhinta	0,00	4,02	9,0	2,3	6,7	9,0	10	-1,0	9,0	9	0,0	21,5 13,6	9	4,6-12,5
			4,9	2,3	2,6	4,9	10	-5,1	4,9	9	-4,1	21,5 13,6	9	4,6-12,5
Saunalahtelainen	0,00	4,02	12,3	2,3	10,0	12,3	10	2,3	3,3	9	-5,7	21,5 13,6	9	4,6-12,5
Saunalahti GSM	7,38	0,00	11,4	2,3	9,1	11,4	10	1,4	11,4	9	2,4	21,5 13,6	9	4,6-12,5
Saunalahti Lanka	0,00	2,42	8,2	2,3	5,9	8,1	10	-1,9	8,2	9	-0,8	21,5 13,6	9	4,6-12,5
			+0,82 / min						+0,82 / min			21,5 13,6	9	4,6-12,5
Paketti Plus 1)	0,00	16,31	8,1	2,3	5,8	8,1	10	-1,9	8,1	9	-0,9	21,5 13,6	9	4,6-12,5
Tekstari 2)	0,00	7,38	10,6	2,3	8,3	10,6	10	0,6	10,6	9	1,6	21,5 13,6	9	4,6-12,5
Saunal GSM plus	0,00	4,88	8,6	2,3	6,3	8,6	10	-1,4	8,6	9	-0,4	21,5 13,6	9	4,6-12,5
Puhu hyvää	7,38	0,00	11,4	2,3	9,1	11,4	10	1,4	6,5	9	-2,5	21,5 13,6	9	4,6-12,5
YritysGSM plus 3)	0	0	7,4	2,3	5,1	7,4	10	-2,6	5,3	9	-3,7	21,5 13,6	9	4,6-12,5
Prepaid 4)	8,20	0,00	8,2	2,3	5,9	8,2	10	-1,8	8,2	9	-0,8	21,5 13,6	9	4,6-12,5

1) includes 450 call minutes to all national GSM and fixed subscriptions

2) includes 1000 SMSs/month to all mobile subscriptions

3) prices without VAT; minimum charge 3,5 Euros/month

4) Starter kit of 10 Euros includes call minutes of value 10 Euros

5) Estimate (max): Transit 0,7cents/min + local termination 1,6 senttiä/min

VAT = 1,22