



GSM Europe
The European interest group of the GSM Association
<http://www.gsmeurope.org>

GSM Europe paper on Use of Gateways for Mobile Communications

Introduction

This document has been drafted by GSM Europe¹ in order to raise awareness of the problems being experienced by mobile operators due to widespread deployment of GSM Gateways. The term “GSM Gateway” is now commonly used for equipment which enables the routing of voice calls to mobile subscribers by establishing a mobile to mobile call from fixed apparatus (the term “SIM Box” is also used with the same meaning). Such equipment is being deployed widely across mobile networks without prior consent of the network operators and is resulting in quality impairments, network congestion and safety/security concerns.

The document firstly describes the GSM Gateway call routing mechanism and then explains the reasons why this type of arrangement can cause significant problems for both mobile operators and their customers; such problems particularly relate to:

- consumers’ interests, whereby mobile operators are prevented from offering high levels of network availability and quality.
- planning and operational issues for mobile networks since Gateways can cause inefficient use of allocated frequencies and introduce a high risk of network congestion and service disruption (most value added services will not function without proper transmission quality and delivery of calling line identity, CLI)

Finally, the document provides some recommendations in order to prevent quality impairments caused by the commercial use of Gateways.

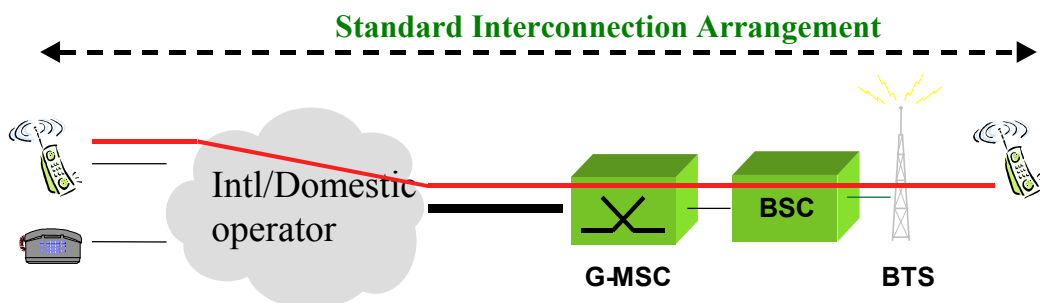
¹ GSM Europe is the European interest group of the GSM Association, the premier global body behind the world's leading wireless communications standard. GSM Europe represents around 143 operators in 50 countries/areas in Europe and counts around 380 million subscribers.

1. GSM Gateway Description

GSM Gateways are devices whose original purpose was to allow fixed line telephones to interface with mobile networks. The fixed line telephones are connected to the device that contains one or more GSM SIMs. The GSM Gateway then connects calls made by the fixed line telephones to the GSM network using the SIMs contained within it.

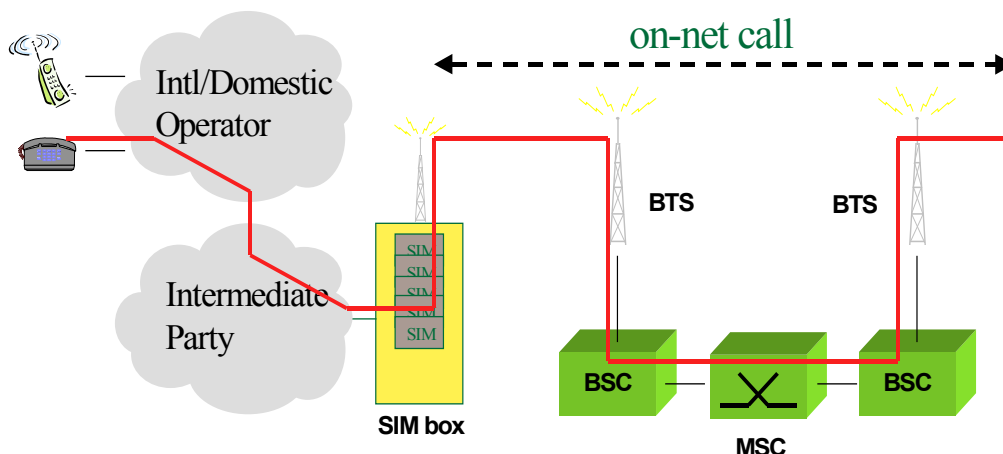
The standard call routing arrangements between networks is shown in Diagram 1 below. This is the classical way of conveying calls which maximises network efficiencies and call quality through industry standardised interfaces and processes. It is also consistent with European and national regulatory obligations relating to network interconnection.

Diagram 1



The GSM Gateway connection arrangement is shown in Diagram 2 below. In this case calls from another network are made to appear as mobile to mobile calls on the GSM network. This is likely to create significant quality, congestion, service disruption and security problems for mobile networks especially since such arrangements are established without the prior consent or knowledge of the mobile network operator.

Diagram 2



Some networks allow corporate customers this type of access to provide direct connection with the customer's private network, effectively creating a type of virtual private network (Note: Corporate customers do not have an Operator's Licence and may not be able to ask for Interconnection to the mobile network) In such cases, services are normally restricted to

closed user groups under the control and knowledge of the mobile operators thereby minimising any quality or congestion impairments.

However, apart from the use described above, GSM Gateways are increasingly being used by national and international voice carriers via third parties or re-sellers who may not even have an operator's licence to route calls to GSM networks. In such cases mobile operators are unaware of the deployment of such GSM Gateways, resulting in unpredicted network behaviour and quality problems. With this type of connection, customers may be denied the normal industry standard quality guarantees expected of public networks.

2. Problems Caused by GSM Gateways

Most operators have expressed serious concerns regarding the use of GSM Gateways, especially in the case of inter-working between public networks and international carriers.

There are four key areas where we have concerns as shown below:

- Spectrum management and network planning and operation concerns;
- Consumer detriment as a result of service disruption or service unavailability;
- Lawful interception requirements on operators / security concerns;
- Legal issues.

2.1 Spectrum Management and Network Planning Concerns

2.1.1 Spectrum Inefficiency

The use of GSM Gateways significantly reduces spectrum efficiency (because they use two radio channels for the mobile to mobile call when only one radio channel is required for the 1 fixed to mobile call that is being replaced). Proposals that encourage the use of additional radio resource, where it is not required, may be inconsistent with statutory duties of radio authorities.

2.1.2 Network Planning and Operation

The use of GSM Gateways causes network capacity problems. GSM Gateway equipment is fixed and contains large quantities of SIM cards making large volumes of calls. The network therefore experiences abnormally high demand on individual cells and this causes congestion. Cell sizes are becoming very small in the areas where GSM Gateways are typically located. High concentrations of users may be unsupportable in these areas as it is likely to be impossible to shrink cell sizes any further and add additional infrastructure (capacity). As a consequence, mobile users can be denied service (particularly since GSM Gateways often 'grab' the available cell capacity from early in the morning until late at night).

The precise, overall level of traffic using GSM Gateways is unknown, however it is clear that use is increasing significantly (millions of minutes/months). The impact of this is illustrated by the following case study of the UK:

(If 20% of minutes terminating on mobile networks were to route through GSM Gateways, this would be equivalent, across the four UK 2G mobile operators, to approximately **5 billion** minutes per year. The origination of this volume of traffic in

urban areas will require very significant increases in network capacity by all operators. Given planning restrictions, the sensitivity to building sites and the time and difficulty of finding new sites it is hard to see that this demand could be met in a timely way with the result of service degradation generally being suffered by customers)

2.1.3 Network Utilisation and Efficiency

There is an increase in network utilisation as a mobile originating call is generated for every terminating call routed through a GSM Gateway i.e. two radio channels and associated equipment are used for each call instead of one. In normal circumstances the call would be routed onto the network via a standard interconnect route, making use of fewer network resources.

2.2 Consumer Impact

2.2.1 Detriment Due to Non-delivery of Signalling Data

The GSM Gateway arrangement does not allow the delivery of the Calling Line Identity (CLI) of the calling customer, resulting in mobile consumers being unable to use services that they would expect to be able to use.

These services include:

- returning a missed call;
- sending an SMS;
- screening unwanted or malicious calls;
- using an anonymous call rejection system, if that is offered by the operator;
- using CLI to manage costs when roaming abroad – i.e., customers may use CLI to decide whether to accept the call;
- other CLI based services offered by the operator, such as: seamless access to voice mail, the development of a virtual home environment, and in general the roll out of all services based on an authentication of the customer and cross reference to network databases;
- direct voice mail retrieval when roaming abroad;
- voice mail retrieval with the short code when roaming abroad; and
- voice mail deposit when roaming abroad (and not taking a call or out of coverage area).

In addition, customers roaming on foreign networks may be unable to receive calls if they have been routed via GSM Gateways. These limitations need to be considered against regulatory and industry guidelines for the delivery of CLI.

Furthermore, article 8 of Directive 2002/58 concerning the processing of personal data and the protection of privacy in the electronic communications sector ("Privacy Directive") deals with calling line identification ("CLI").

The Privacy Directive places certain obligations on service providers regarding the provision of CLI. It is our view that GSM Gateways compromise the integrity of CLI and as a result service providers may not be able to fulfill their regulatory obligations in this regard".

2.2.2 Service Disturbance

GSM Gateways using prepaid SIM Cards are not able to re-route calls when the SIM Cards run out of credit and the calling customer is unable to establish a connection or an existing live call is terminated. There is no technical way of allowing GSM Gateway's users to control the level of recharges made and to prevent the prepaid SIM Cards running out of balance.

This situation seriously affects the reputation of GSM mobile networks and the service quality experienced by users (which may also affect the operators' ability to satisfy license obligations). Some operators have been able to assess the level of complaints from customers whose calls have been routed through GSM Gateways and serious quality problems have been experienced by both inbound and outbound roaming customers. A typical call scenario is described below:

When calls pass through prepaid SIM Cards inserted inside GSM Gateways and where those SIM Cards are not recharged in real time (service balance expired), customers using a regular / post-paid service may not be able to complete the call. At the same time the customer receives the following message: "YOUR ACCOUNT BALANCE DOESN'T ALLOW THE CALL COMPLETION". This has no relevance to customers trying to complete the call where they are using post-paid services, so there is no sense in receiving the message. Mobile operators cannot control this situation and are subjected to high levels of complaints, churn, diminished service reputation in the market and customer requests for financial credits (for example: customer was not able to conduct business while abroad, etc).

In addition, quality issues can arise when customers try to use certain supplementary services and are not able to do so because GSM Gateways are not configured to allow it. A good example is a customer trying to send a fax message, which will never be delivered to the respective destination because GSM Gateways were not configured for that type of service.

2.2.3 Ability of Mobile Customers near GSM Gateways to Make or Receive Calls

The use of GSM Gateways on mobile networks will have an adverse impact on customers' experiences as the excessive demand placed by GSM Gateways on certain cells will result in poor network coverage in some areas. Mobile customers may be unable to make or receive calls during business hours when GSM Gateways operate at full capacity and use all, or nearly all, of the cell capacity.

This will also impact on emergency calling, and cause impact on operators' ability to fulfil obligations in respect of emergency calling.

2.2.4 Lost Calls and Call Routing Problems

Interconnection capacity is monitored and adjusted according to the utilisation levels and the availability of overflow routes, but this cannot happen in case of GSM Gateways. This means that any congestion relating to the use of GSM Gateways (which is very common) results in the loss of calls.

Calls to mobile subscribers can also fail under certain call scenarios where the called subscriber is roaming or where the called number has been ported to another network within a country where a mobile portability solution has been adopted using a central IN platform. This damages the customer experience and makes it difficult for network operators to identify the causes of such call failures.

2.2.5 Increased Call Set-up Time

The nature of the GSM Gateway call set-up process will also result in the calling party experiencing an increased post dial delay. This may create an erroneous perception of poor network quality thus reflecting badly on the operator of the network which terminates the mobile connection; this will also have an impact on emergency calling. In most cases the customer is unaware that the call is being routed through a Gateway.

2.2.6 Deterioration in Voice Quality

Whilst cellular voice quality is now generally very good, in the case of GSM Gateways, the well known propagation difficulties of the radio environment are likely to cause an increase in dropped calls which is an undesirable consequence to both the called and calling parties. This is due to the fact that with GSM Gateways two radio legs rather than one are involved. Again this will have an impact on emergency calling.

3. Lawful Interception Requirements

In cases where calls are routed via GSM Gateways, the CLI of the originating party is not transferred or is manipulated and the called party will receive the CLI of the SIM card that is used in the Gateway.

Most operators have licence obligations to co-operate with the Law Enforcement Agencies who have the authority to request identification and monitoring of mobile traffic (using the GSM MSISDN number/ CLI). Since the real CLI of the originating party is not known, the mobile operators cannot fulfil these obligations. In some cases (e.g. Belgium) the police authorities have already addressed a letter to a mobile operator requesting clarification of this problem.

The absence of a correct CLI also prevents an operator from detecting the origin of malicious calls and can therefore not help affected customers. Finally the incorrect CLI endangers the correct handling of emergency calls (normally a licence obligation) where CLI is used to detect the victim's location. This is a subject of general interest where the mobile operator cannot take up his responsibilities of 'good corporate citizenship'.

4. Other Legal Issues

As radio transmitting devices, GSM Gateways within the European Union must meet the requirements of the R&TTE Directive as implemented by the Radio Equipment and Telecommunications Terminal Equipment Regulations 2000. Harmonised European specifications for many GSM transmitters in close proximity do not exist and it is not clear if

the devices use one or many antennas. This may lead to impaired performance and potential interference to other GSM users arising from intermodulation products. This may be a breach of the essential requirements set out in paragraph 4 of those Regulations. Furthermore, the increased power arising from the large number of transmitters means that safety considerations must be evaluated in accordance with paragraph 4(2) of the Regulations.

Most mobile network operators have legal and regulatory obligations in relation to the services they offer according to their licence conditions. To comply with these obligations, they need to plan and manage their networks. They have obligations to provide certain services that they may be prevented from providing because of the use of devices such as GSM Gateways. This could, for example, affect their obligations in relation to calls to emergency services.

5. Views of Regulatory Authorities

The national regulatory authorities in several European countries have shown an interest in the use of GSM Gateways and at least two authorities have carried out reviews. In Ireland, ComReg has issued Information Notice (03/15 dated 5 February 2003) which states that the “use of Gateways as a form of interconnection is unacceptable” and encourages mobile operators to carry out enforcement procedures. In Germany, RegTP has decided not to forbid the use of Gateways but is supportive of mobile operators changing their terms and conditions to prevent their use.

In the UK, after a lengthy review by the Radio Agency, the Government has announced that the use of Gateways by third parties will remain illegal under existing legislation. Finally, in Spain, on 19 June 2003, a CMT resolution stated that they considered there to be a number of problems with operator usage of GSM Gateways. Such problems included: reduction of quality of service, reduction of users’ information rights and difficulties with legal interception (the last two items due to lack of calling party CLI information).

The use of GSM Gateways for traffic re-selling could also be in breach of service level agreements since user contracts generally do not cover the re-selling of voice traffic. In such cases, the use of GSM Gateways for traffic reselling could constitute a fraud. This argument is currently being used by Operators as one of the reasons for withdrawing service from GSM Gateway users.

6. Summary and Recommendations

For the reasons outlined in this document, most mobile operators are concerned about the congestion, quality and user experience impairments associated with the use of GSM Gateways. This particularly applies to the uncontrolled use by carriers where mobile operators may have no prior knowledge and have to make unpredictable network planning and optimisation changes.

This issue is currently being discussed by regulatory authorities within the ERG (European Regulators Group). GSM Europe therefore intends to raise these matters with the European Commission and industry bodies with the aim of ensuring that mobile operators are protected from the unauthorised use of GSM Gateway devices.

GSM Europe believes that mobile operators should be free to implement measures to prevent the use of GSM Gateways by third party carriers. The option being implemented by most

operators is to ensure that commercial terms and conditions exclude the use of GSM Gateways for routing third party traffic. Operators should then also be free to detect, identify and terminate such subscriptions which are in breach of contract or in breach of any national legislation preventing the use of such devices.

However, the legality of such action varies from country to country and a “disconnection” regime would simply not address the CLI and legal interception issues outlined in this paper; it is likely to lead to an environment of continual complaints/ disputes as to cause of disruption and it only addresses the issue after the disruption to bona fide mobile usage has been caused.

Given the limits of the “disconnection” regime mentioned above, GSM Europe would recommend that the European Commission encourage Member States to prohibit the use of GSM gateways for the conveyance of third party traffic by carriers. Such carriers should instead be required to establish proper interconnection paths either directly with mobile operators or via transit operators who themselves have direct interconnection and can provide the appropriate service quality levels.

GSM Europe would further recommend that the use of GSM Gateways by private and corporate users should remain possible but that mobile operators should be free to define reasonable commercial terms and conditions to protect the integrity and quality of their networks.

Furthermore, "the European Commission ("the Commission") have, through article 8(4)(f) of Directive 2002/21 on a common regulatory framework for electronic communications networks and services ("Framework Directive"), stated that national regulatory authorities ("NRA") shall promote the interests of the citizens of the European Union by ensuring that the integrity and security of public communications networks are maintained.

It is our belief that the use of GSM Gateways compromises the integrity and security of our members' networks and as a result our members' regulatory obligations may be called into question by the relevant NRA .

We believe the measures we have recommended above would address the increasing impairment of mobile operators to comply with their licence obligations due to the commercial use of gateways and would enable them to offer the highest level of quality of services to their customers throughout Europe.

GSM Europe, London 3rd September 2003