Commission for
Communications Regulation

Consultation Paper

Review of VoIP Framework

Document No:	**06/13**
Date:	**3rd March 2006**

All responses to this consultation should be clearly marked:- "Reference: Submission re ComReg 06/13" as indicated above, and sent by post, facsimile, e-mail or on-line at www.comreg.ie (current consultations), to arrive on or before 5p.m., 13th April 2006, to:

Ms. Sinead Devey
Commission for Communications Regulation
Irish Life Centre
Abbey Street
Freepost
Dublin 1
Ireland

Ph: +353-1-8049600 Fax: +353-1-804 9680 Email: frameworkconsult@comreg.ie

Please note ComReg will publish all respondents submissions with the Response to this Consultation, subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24

Contents

1 Foreword

Voice over Internet Protocol (VoIP) (sometimes known as Voice over Broadband) is a technology that allows users to make and receive calls over an Internet Protocol (IP) transmission network (including the Internet) rather than the Public Switched Telephone Network (PSTN).

Over the course of 2004 and 2005, the Commission for Communications Regulation (ComReg) put in place a new framework designed to facilitate the entry of VoIP service providers into the Irish telecommunications market. These are seen as a new force for fostering marketplace competition and benefiting the consumer, while at the same time introducing certain technological enhancements and greater network efficiencies. These new technologies nevertheless also suffer from certain limitations, at least for the present, so ComReg has striven to ensure the avoidance of any harmful effects for consumers, or long-term damage to the wider communications infrastructure.

Among other changes, ComReg opened the national numbering scheme to ensure it met the needs of the new category of VoIP provider. As a first step, widely demanded by VoIP SPs, ComReg widened the eligibility criteria for geographic numbers to include those service providers offering VoIP based communication services. Even more importantly, a totally new number range ("076") was specifically designated for use with IP-based services, with relatively flexible conditions of use.

As a further step, ComReg published a set of guidelines[1] for VoIP service providers, aimed at helping them to ensure their services offer maximum benefit to consumers, while also ensuring that consumers purchasing those services are alerted to any limitations in service they can expect to encounter.

It is envisaged that these measures will encourage service providers to continue to offer exciting new and innovative services to the public, while nevertheless meeting all reasonable obligations to and expectations of their customers. In particular, end-users should be able to enjoy levels of protection (for example, ensured access to the emergency services) similar to those that they would experience from service

[1] "Guidelines for VoIP Service Providers on the treatment of consumers"; ComReg document 05/50

providers of traditional telephony, except for cases where they – the end-users – knowingly choose otherwise.

As the framework described above has evolved over the last couple of years and still continues to mature, ComReg has recently undertaken a review of its operation, with assistance in certain areas from Analysys Consulting. The purpose of this review was to identify any gaps in the existing VoIP framework that could in some way limit the development of this market. This document describes the results of this review and *inter alia* looks into existing obligations related to consumer rights and protection. It also considers whether any new steps can or should be taken to further stimulate the market. As part of this forward looking exercise, this document introduces the topic of IP interconnection to an audience perhaps more *au fait* with interconnection based on circuit-switched technologies.

Given that this document is relevant to both service providers and consumers, ComReg welcomes responses from all interested parties. The deadline for those responses is April 13th 2006.

Isolde Goggin
Chairperson

2 Executive Summary

Over the course of 2004 and 2005, and as a result of a number of public consultations and industry meetings, ComReg set out a comprehensive framework[2] that facilitated VoIP service providers who wished to enter the telecommunications market in Ireland. This framework clearly sets out the legislative obligations that fall on those service providers who offer VoIP services to consumers, as well as ComReg's expectations as to how these service providers should educate existing and prospective customers regarding the differences (in terms of consumer protection issues) between traditional fixed line telephony products and new VoIP products.

ComReg's existing decisions on numbering are considered to be at the forefront of decisions made in relation to the facilitation of VoIP services, both in the European Union and further afield. These decisions include making geographic numbers and a new range of numbers for IP-based services (the "076" number range) available to VoIP service providers. The "076" range has fewer regulatory restrictions than other ranges. In particular, it was the intention that the elimination of geographic restrictions would make these numbers especially attractive to VoIP service providers as this would permit the nomadic element that is a distinguishing feature of many VoIP services. This framework also set out some of the wider obligations in relation to access to the emergency services, number portability, and Calling Line Identification (CLI) amongst others.

In the main framework document (04/103), "VoIP Services in Ireland", ComReg committed to reviewing the progress of the VoIP market in light of the decisions made in that paper. Following on from this commitment, ComReg initiated this review in October of 2005, enlisting Analysys Consulting to assist with this task. Analysys Consulting has in the past provided advice to the European Commission in the areas of VoIP and associated convergent services. During the course of this review, interviews were conducted with a representative sample of stakeholders from those providing VoIP services. The resulting information and opinions were taken into consideration when formulating this consultation paper.

In structuring this review, the aim was to identify any gaps in the existing framework, and if necessary to propose mitigating strategies to ameliorate these.

[2] This framework consists of ComReg documents 04/103, 05/23 and 05/50.

Particular areas that were addressed include number portability, social obligations (such as the provision of access to emergency services) and other emerging consumer issues (such as port blocking). Of particular interest in this area are the obligations that derive from the VoIP service classification and the implications that ensue. Under the Authorisation Regulations (S.I No 306 of 2003), any person may provide an electronic communications service, provided they have notified ComReg in advance. Under the terms of these regulations, operators are free to commence operations once a completed notification has been received, but operations are subject to the conditions set out in a General Authorisation. There are further obligations associated with the provision of PATS, mainly concerned with the provision of further consumer-related rights. If service providers market their products in such a way as to create unrealistic consumer expectations, then it is likely that this will result in some damage to the VoIP market.

Number portability, being a key facilitator of consumer choice and effective competition, is of particular interest to both service providers and consumers. Working processes exist for both geographic and non-geographic numbers, and those interviewed agreed that these were acceptable, although they may not exploit the full flexibility of services based on IP.

Another area that was felt to merit attention is that of interconnection. There are a number of different types of interconnection used by IP based service providers, either involving circuit-switched gateway technology or purely based on IP networks. Interconnection already occurs quite seamlessly on a purely IP – IP level, while that between IP – PSTN has been facilitated by the opening of a new number range (076) for this purpose.

There are other elements that may impact on this framework. These elements could include guidance issued by the European Commission, the ITU-T, OECD, IETF, IRG/ERG and other international bodies. It is possible also that both the market review process[3] (which is subject to the existing regulatory framework) and the review of that framework, may have some impact. Going forward, ComReg will continue to monitor the Irish VoIP market, and take account of events and developments, both national and international, in the IP world.

[3] The market review process seeks to determine which markets will continue to be subject to ex-ante sector-specific regulation, the companies that will be regulated in those markets and the obligations that they will face.

3 Introduction

Over the course of 2004 and 2005, ComReg put in place a comprehensive framework to facilitate the introduction of VoIP services into the Irish telecommunications market. This framework focuses mainly on consumer protection issues, and has been broadly welcomed. As part of the introduction of this framework, ComReg committed to reviewing it after a reasonably short period of time. The reason for this commitment was that given the relatively few VoIP services available in Ireland, and indeed worldwide, it would be prudent to ensure that the framework provided a level playing field for all players, and that it did not inadvertently establish any regulatory disincentive to these players. This of course has to be balanced with the fact that existing resources, such as the National Numbering Scheme, have to be managed in an efficient manner, for the benefit of *all* Irish public telecommunications users.

In conducting the review of this framework, ComReg enlisted the help of Analysys Consulting, who wrote the report "IP Voice and Associated Services"[4] for the European Commission. Analysys Consulting conducted several interviews with a wide ranging sample of service providers in the VoIP market. Various questions were put to those interviewees, and these questions and the resulting feedback received form the basis of this consultation document. The existing framework, pertinent consumer issues (including numbering) and various interconnection issues were all discussed during these conversations. This exercise gave ComReg a valuable indication of the direction that the VoIP services in Ireland are taking, and this current consultation consolidates that exercise, while also permitting a wider range of stakeholders to have a say.

This paper focuses on the consumer issues that relate to services that are provided using VoIP rather than PSTN. It does not attempt to answer the question "Are VoIP services regulated in the same manner as PSTN services?" The answer to this question will depend on the particular market that a specific service falls into and is more correctly dealt with in the separate market analysis work streams.

In structuring this review, the aim was to identify any gaps in the existing framework, and if necessary to propose mitigating strategies to improve these.

[4] http://europa.eu.int/information_society/policy/ecomm/doc/info_centre/studies_ext_consult/ip_voice/401_28_ip_voice_and_associated_convergent_services.pdf

Particular areas that were addressed include number portability, social obligations (including access to emergency services and related topics) and other consumer issues (including port blocking). Of particular interest in this area are the obligations that derive from the VoIP service classification and the implications that ensue. If service providers market their products in such a way as to create unrealistic consumer expectations, then it is likely that this will result in some damage to the VoIP market.

Interconnection, both purely circuit-switched, purely IP-based and a mixture of the two (i.e. circuit-switched to IP), is already operational in the VoIP market. In this section, ComReg describes the types of interconnection products that can exist, whether currently operational or potential, and addresses whether ComReg has a positive role to play.

Other elements, including the market review process, may impact on the existing framework. This paper concludes with a look at some of the future work that ComReg may need to undertake.

4 Existing Framework

4.1 Existing Framework for VoIP Services in Ireland

In order to facilitate the introduction of VoIP services into Ireland, ComReg published a consultation ("Numbering for VoIP Services", 04/72) and subsequent response to consultation ("VoIP Services in Ireland", 04/103), in July and October of 2004 respectively. These documents, together with the subsequently published "Guidelines for VoIP Service Providers on the treatment of consumers" (05/50), form the basis of ComReg's existing regulatory framework specifically[5] for those Service Providers (SPs) who offer VoIP services to Irish consumers. This framework has clearly set out the legislative obligations that fall on SPs who offer electronic communications services to consumers, as well as ComReg's expectations to date as to how these SPs should educate existing and prospective customers regarding the differences in the provision of consumer protection between traditional fixed line telephony products and VoIP products.

The response to consultation document 04/103 set out the rights and obligations that specifically relate to the National Numbering resource. A range of other important consumer protection issues, such as how access to the emergency services agencies might be managed were also introduced, and preliminary approaches set out in that document. The purpose of this current review is to ensure that there are no gaps that might be exploited to the detriment of the consumer or the market, but also to provide clarity on the existing framework.

ComReg 05/50 (Guidelines for VoIP Service Providers) went further to assist service providers, setting out the existing legislative obligations and rights. That document also clearly sets out ComReg's expectations as to what measures SPs should undertake to ensure that their clients (as well as the users[6] of their products) are sufficiently informed and aware of any fundamental differences between traditional and new voice products. It is not ComReg's intention to differentiate VoIP from traditional products in a negative manner. However it remains the opinion of ComReg that users need full and correct information in order to make an educated decision on what the correct product is for their particular situation.

[5] Of course pre-existing rules that affect non-VoIP operators may also be relevant to VoIP.

[6] It is likely that some users of the service will not be aware of the underlying technology or any related limitations. Therefore users as distinct from clients also need to be informed of these differences, particularly in relation to access to emergency services.

5 Numbering

5.1 Introduction

It is widely agreed that the availability of numbers is crucial to the widespread uptake of VoIP services. ComReg's existing decisions on numbering[7] are considered to be at the forefront of the treatment of VoIP, both in the European Union and further afield. The main thrust of these decisions is that geographic numbers were made available for allocation to both PATS and ECS VoIP service providers, and just as crucially that a new range of non-geographic numbers was made available specifically to support such services.

The responsibilities of ComReg in respect of the management of the National Numbering Scheme are set out in the National Numbering Conventions (NNC)[8]. They state that the scheme should be managed in a manner which provides sufficient capacity and flexibility to meet future demands, whilst ensuring equal treatment for all with respect to access to numbers.

This section addresses the various types of numbers that ComReg has made available to VoIP service providers as well as the allocation rules that surround those numbers. Number portability is also discussed.

5.2 Geographic

5.2.1 Allocation outside Minimum Numbering Area (MNA)

As mentioned previously, both ECS and PATS VoIP service providers are now entitled to allocations of geographic numbers. ComReg's rules concerning allocation of geographic numbers to VoIP service providers are currently amongst the most liberal in Europe.

Geographic numbers are available to every telephone line holder in the State, with approximately 2 million access paths in situ[9]. Only a very small proportion of these lines are currently operated by means of a technology other than the traditional PSTN/ISDN.

During the time that it has taken for the national telecommunications network to evolve, people have associated the STD (Subscriber Trunk Dialling) codes with the

[7] See ComReg documents 04/103 (VoIP services in Ireland) and 05/23 (Directions to enable opening of access to VoIP services based on 076 number ranges)

[8] ComReg document 05/62 (National Numbering Conventions V5.0)

[9] ComReg document 05/73 (Quarterly Key Data Report, September 2005)

relevant geographical areas (e.g. 021 with Cork, 091 with Galway). More importantly, emergency call procedures have also evolved with the geographic relationship of the number used as a critical way of identifying the location of the caller.

In addition to the association with particular geographical regions, people also benefit from a certain level of tariffing information that is gleaned from this type of number. It can be easily determined[10] whether a call to a certain number would incur national rate charges rather than local rate[11].

The nature of VoIP means that in contrast to legacy networks, geographic numbers could technically be utilised without regard to the physical geographic location of the end-user and area for which the number is allocated. If this is allowed to happen, any user anywhere in the world could request an allocation of an Irish geographic number, potentially even multiple numbers from many different geographic areas. This could lead to a situation where an excessive demand for Irish geographic numbers from outside of the state could trigger costly capacity-based number changes, without clearly identified Irish-based economic benefits in return.

Number changes, which are instigated as a last resort, are expensive (both in terms of overhead for the involved network operators and the ancillary expenses incurred in migrating stationery, advertising material etc.). This cost, which is certainly not trivial, must be borne by the network operator, service provider and end users. There is also an impact, either permanent or short-term, in lost contacts by consumers.

Given the current level of VoIP penetration in the Irish market and the high risk of enforced number changes from a further relaxation in rules, it is ComReg's present opinion that the current liberal rules[12] surrounding the allocation of geographic numbers should remain in place for the immediate future.

[10] In some cases this particular element is being diluted given the advent of all-Ireland tariffing plans together with the introduction of various pricing bundles.

[11] In this respect, the tariff applied (either local or national) is that of the originating service provider.

[12] The rules permit these numbers to be used for VoIP purposes but they must only be allocated to end-users or termination nodes located within the Minimum Numbering Area (MNA).

Q. 1. Do you agree with ComReg that the rules surrounding the allocation of geographic numbers should remain in place for the immediate future[13]? If not, please describe the changes you would wish to see and explain why you feel these are needed, given the availability of highly-flexible "076" numbers (as discussed in the next section).

5.3 "076" number range

In 2004, ComReg decided to open a range of numbers – the "076" range – specifically for IP based services[14] with fewer regulatory restrictions than other ranges. It was the intention that the elimination of geographic restrictions would make these numbers especially attractive to VoIP service providers as this would facilitate the full nomadic element that is a distinguishing feature of many VoIP services.

ComReg set a retail tariff ceiling of a national rate for this number range[15]. The actual charge can be anywhere below this level in practice, as service providers are not precluded from entering into commercial negotiations to establish other wholesale interconnection rates. The wholesale interconnection rate used influences the retail rate that end-users are charged.

As progress in opening the new range was slow, ComReg intervened in order to move the framework forward in such a way that benefited all undertakings fairly while simultaneously bringing the benefits of VoIP to the consumer without further delay. This involved setting one initial retail price point[16] (to be equivalent but not linked to *eircom*'s then local rate[17]), and requiring access to "076" numbers to be opened, based on it. Service providers were not, and are not, precluded from entering into commercial negotiations to establish other underlying wholesale interconnection rates.

[13] Please note that the focus of this paper relates solely to VoIP; an extensive review of the wider national numbering scheme is not appropriate here.

[14] Decision No.8 of 04/103

[15] The maximum charge that can be applied to calls to "076" numbers shall not exceed the standard national rate of the network operator from which the call is made

[16] ComReg document 05/23 (Directions to Enable Opening of Access to VoIP Services using 076 Number Ranges)

[17] The current actual per second rates are 0.0679c, 0.0174c and 0.0174c for daytime, evening and weekend respectively

During the discussions held by Analysys Consulting with a range of stakeholders from the VoIP industry in Ireland, no serious concerns were raised in relation to either the level at which the price point has been initially set, or in relation to the interconnection settlement regime that is used to calculate the relevant retention rates[18]; ComReg has therefore concluded that no changes are currently required in that area. There was consensus among these stakeholders that the single price point sends a clear and easily understood tariff signal to the market, and that this clarity was important in encouraging the adoption of VoIP.

5.3.1 Awareness of range

During interviews with key stakeholders in the run up to this current consultation, it became apparent that there is still quite a low level of take-up of numbers from the "076" range. The reasons suggested for this were varied. Many stakeholders held the opinion that VoIP services, particularly in the residential market, are somewhat restricted to broadband customers (notionally if not technically). Corporate or business customers are more likely to port their existing geographic numbers, rather than take new numbers. It was also noted that as consumers are somewhat unaware of the applicable "076" pricing, this could also deter their take-up of such a number. Nevertheless, although the numbers had only been in active use for 3 to 4 months, a discernable growth in traffic could be identified even in that time; this could therefore indicate more rapid growth in demand for numbers going forward as services based on "076" numbers become more common.

ComReg believes that as more consumers adopt broadband for their Internet access mechanism, they are likely to become aware of VoIP and therefore of this particular number range. Associated tariff information will also become more familiar. In addition, Analysys Consulting recommended to ComReg that it could be useful for VoIP service providers to promote wider consumer awareness of the "076" number range. The more people who are aware of the "076" range of numbers (and their associated benefits, particularly the nomadic element), the faster the overall awareness and therefore utilisation of the range will grow.

Another point that arose from the discussions held by Analysys Consulting with stakeholders was that there is a growing demand from consumers for one number that could be used as a single point of contact. This single point of contact could

[18] Please see ComReg 04/103 Section 4.7 for a full discussion of these issues

theoretically be used on a variety of access mechanisms, such as wireless (or WiFi), mobile, WiMax, amongst others. Indeed, Analysys noted that the establishment of the "076" number range could anticipate a future in which consumers may desire a single contact number, which is not necessarily associated with a particular type of service, whether fixed, nomadic or mobile.

Q. 2. Do you agree that the existing arrangements with respect to the "076" number range adequately fulfil the current requirements of VoIP service providers?

Q. 3. Do you agree with Analysys' comment that the "076" number range could be used as a single point of contact across a variety of access mechanisms?

6 Provision of Voice Services: Associated Obligations and Consumer Issues

6.1 Introduction

There are various types of telecommunications services that are being provided to consumers using several technologies, including IP. Some are services are being marketed as add-on products (i.e. where it is not expected that the purchaser would give up their existing telecommunication service) and some are being marketed as a substitute product (i.e. where it is expected that the purchaser would give up their existing telecommunications service).

If, however, there are differences between what consumers might legitimately expect of the service that they are buying and the service that they are actually be provided with, ComReg believes that it is vital that consumers are fully informed of these differences. Service providers are likely to provide full information in relation to those marketable elements of their service that differentiate their service from others. It is also important that they inform their customers of the possible differences those customers might experience when attempting to call the emergency service agencies or of service outages that could occur as a result of a fault in their underlying Internet access (among others). To this end, in July of 2005, ComReg issued a guidelines document to aid service providers in communicating these differences to their customers and end-users[19].

The remainder of this section deals with the Universal Service obligations that different classifications of services must offer, and suggests a framework that might practically deal with these.

6.2 Provision of Voice Services and Associated Obligations

In order to provide electronic communication services in Ireland, the service provider is required to have provided a notification to ComReg in connection with a General Authorisation; its operations are subject to the conditions set out in this General Authorisation. As previously mentioned, there are two different classifications for the provision of telecommunications services, Electronic Communications Services (ECS) and Publicly Available Telephone Services (PATS). All Electronic Communications Services are obliged to fulfil certain conditions, and further obligations are associated with the provision of a service

[19] ComReg document 05/50 "Guidelines for VoIP Service Providers on the treatment of consumers".

classified as PATS. These obligations are not, and should not be seen as, trivial or optional. If, as a result of the market review process, an Undertaking is designated as having Significant Market Power (SMP), obligations may be imposed on this Undertaking as a result of remedies intended to resolve the competition problems identified during this process. These SMP obligations are separate to those discussed in this paper[20], which are the result of offering Electronic Communications Services or Publicly Available Telephone Services. The latter obligations (which are principally aimed at ensuring end-user protection) are discussed further below in Section 6.2.3.

6.2.1 ECS

The Framework Regulations[21] define an electronic communications service as a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks. Therefore any communications services which is provided over an electronic communications network (which include packet-switched networks and the Internet) for either a subscription or Pay-as-You-Go type payment is considered to be an electronic communications service. Providers of ECS are required to notify ComReg in connection with a General Authorisation, which obliges them to adhere to a basic list of conditions, as previously mentioned[22]. This is without prejudice to any other obligations that may apply.

6.2.2 PATS

As Publicly Available Telephone Services (PATS) are considered to be a sub-set of ECS, the obligations that apply to ECS continue to apply here, together with other obligations that apply only to PATS services. In the context of the provision of VoIP services, these are fully explained in the aforementioned ComReg document 05/50. The most crucial difference is that when providing a PATS VoIP service, access to the emergency services **must** be ensured.

[20] In ComReg document 06/05, ComReg informed industry and interested parties of its intention to issue a further consultation on the Market Reviews for the Retail markets and for the Interconnection markets.

[21] Framework Regulations, S.I No. 307 of 2003

[22] ComReg document 03/81 "Conditions of General Authorisation"

Other obligations include user rights such as access to directory inquiry and operator assistance services, the right to have an entry in a directory, and various network related obligations[23].

6.2.3 Distinction between ECS and PATS

ComReg believes that a clear distinction should be drawn between ECS and PATS in order to minimise end user confusion and the negative effect that this confusion may have on the growth of the VoIP market. It is important that VoIP PATS service providers understand their obligations and promote their product accurately. In document 04/103, ComReg stated that there

> *"can be no objection to a customer knowingly selecting any particular service, complete with limitations, so long as the selection is done with the full knowledge of what to expect"*

However, if service providers market their products in such a way as to create unrealistic consumer expectations, then it is likely that this will result in some damage to the VoIP market.

During the interviews held by Analysys Consulting with representative VoIP service providers, there seemed to be some confusion as to the exact constitution of a PATS service, as opposed to an ECS one. There is a value in being perceived to offer a "substitute" service, which some VoIP service providers benefit from, despite only offering an ECS service. This value comes from those consumers who attach importance to being able to access the emergency and other ancillary services such as directory entry and inquiry services. If a service provider classified as providing PATS actually provides an ECS service, this could result in the unfair avoidance of certain costs that accrue as a result of meeting these more onerous obligations. It is clearly important to avoid such misclassifications, to avoid misleading consumers, with consequent damage to the industry as a whole, and also to provide a level playing field for those operators who take care to classify their services correctly.

An appropriate mechanism to do this may be to publish a consumer-oriented list that would clearly identify whether the services offered by each individual service provider are classified as PATS or ECS, and to describe also the key obligations of each of these categories. This would effectively be a sub-set of the existing

[23] See ComReg document 05/50 (Guidelines for VoIP Service Providers on the treatment of consumers) for a full explanation of the obligations and rights of telecommunications service providers.

Electronic Register of Authorised Holdings, which is already available from the ComReg website[24]. This would have the benefit of ensuring that consumers are able to verify that the service offered by their service provider meets those it is registered to provide. It might also assist service providers who have inadvertently mis-categorised themselves to make corrections[25].

Q. 4. Do you agree that ComReg should publish and maintain a list, aimed at consumers, of those VoIP services classified as PATS and those classified as ECS, in order that the consumer might have a clear reference point of which obligations their Service Provider ought to offer? If not, are there alternative approaches that you would rather see?

6.3 Access to Emergency Services

Providers of VoIP services that have been classified as PATS are obliged to ensure uninterrupted access to emergency services and also to ensure that end-users are able to call the emergency services (on both 112 and 999) free of charge. Although it is not obligatory for providers of ECS VoIP to offer guaranteed uninterrupted access to the emergency services, ComReg strongly encourages this and in any case requires the ECS provider to inform its customers of any limitations that exist. Indeed, according to Recital 36 of the Universal Services Directive[26],

> *"It is important that users should be able to call the single European emergency number '112', and any other national emergency service numbers, free of charge, from* **any** *telephone, including public pay phones, without the use of any means of payment.[27]"*

ComReg has previously set out an approach[28] that should be taken by ECS VoIP service providers to inform their customers of the possible difficulties that they

[24] http://www.comreg.ie/erau/default.asp

[25] When notifying ComReg of their intention to carry on communication services in Ireland, VoIP service providers should take careful note of the existing VoIP framework, including ComReg documents 04/103 and 05/50.

[26] Directive 2002/22/EC

[27] Essentially this means that despite billing or credit issues, calls to 112 and 999 must still be connected.

[28] Section 4.5.1 of 05/50

may experience in dialling the emergency access numbers. This approach includes providing clear information to this effect to all potential *users* (and not just customers) of the service at the point of sale and point of use and in any user guide provided by the service provider.

It should also be noted that those Undertakings that operate public telephone networks[29] are obliged to provide caller location information[30] to the emergency services.

6.3.1 Nomadic use

All stakeholders who were interviewed agreed that nomadic users of their services presented a special challenge for providing access to emergency services, despite the relatively low proportion of consumers using the VoIP service in a nomadic manner. Some service providers have configured their service in such a manner as to prevent nomadic use; these are typically providing a product clearly designed and marketed as a substitute for the traditional fixed line product. None of the interviewed stakeholders had any immediate solution to this problem of providing caller location information. It should be noted however that there are international bodies (such as the IETF) currently working on standards that would resolve these issues. ComReg strongly encourages service providers to develop solutions that would support the provision of call location information, as a minimum by enabling users to manually update their contact information whenever they are moving their locations.

Q. 5. Are you in agreement with ComReg's comments on how access to emergency services should be handled in a VoIP context?

Q. 6. Do you consider that the VoIP service providers should be required to implement a process to ensure that the current location of nomadic users is kept up to date for the purposes of providing caller location information to the emergency services agencies? How would you consider that this might best be achieved?

[29] Public Telephone Network (PTN) means an electronic communications network which is used to provide publicly available telephone services; it supports the transfer between network termination points of speech communications, and also other forms for communications, such as facsimile and data. (S.I. No. 308 of 2003) (Universal Service Regulations)

[30] S22(2) of S.I. 308 of 2003 (Universal Service Regulations)

6.4 Number Portability

Number portability is a fundamental right of the user. According to the Universal Service Directive, "*number portability is a key facilitator of consumer choice and effective competition in a competitive telecommunications environment".* Its availability in general is likely to drive the uptake of VoIP services, and therefore increase competition in the Irish telecommunications market.

With respect to the obligation to offer number portability, it is both an obligation and a right between those service providers offering PATS services, regardless of which technology they use to deliver those services. Number portability is also a reciprocal obligation, in other words, if a service provider wishes to be a recipient of number portability, it must also be a donor.

Following the decision to allow allocation of geographic and non-geographic numbers to ECS service providers[31], ComReg decided[32] that as a condition of allocation, those service providers are required to support number portability. This is currently achieved using existing processes.

For the new range of "076" numbers, full reciprocal number portability must be supported by all number assignees. As a matter of practicality, ComReg has decided to defer these number portability obligations for the "076" range of numbers until early 2007 or until a significant quantity of these numbers are in active use, whichever comes first. ComReg believed that this was a proportionate measure that balances the rights of the user with the costs incurred in the implementation of any number portability process. ComReg believed that this was a proportionate measure that balances the rights of the user with the costs incurred in the implementation of any number portability process. Following consultations with service providers by Analysys, ComReg has now concluded that this step should occur at an appropriate stage during the first 6 months of 2007, to be decided by ComReg based on quantities of allocations. At that stage, a suitable approach could be to introduce a new number portability process specifically for the "076" range of numbers that would retain the inherent flexibility that IP offers, although the option of extending existing processes to "076" is not dismissed.

[31] Decision 2 of ComReg document 04/103

[32] Decision 12 of ComReg document 04/103

6.4.1 Existing process

Separate processes already exist for both geographic numbers and non-geographic numbers (of which the "076" range is part). These processes were first agreed by industry members in 1999/2000 and they are still operational today. The purpose of these processes is to define the method for establishing and maintaining the Geographic and Non-Geographic Number Portability (GNP and NGNP) service between operators. These processes are not restricted to directly interconnected parties but service establishment testing between both the donor and recipient porting operator must be completed before any porting takes place. It currently appears that number portability is provided to VoIP service providers in an indirect manner, through a third-party which has a direct interconnection with *eircom*. This inevitably adds to the time involved and adds a perhaps unnecessary layer of complexity. The relevant process manuals, which fully explain the requirements and the necessary service establishment tests, are available to service providers from ComReg on request.

Although these processes are fully functional, they were initially developed to cope with circuit-switched PSTN systems and thus may not fully exploit the flexibility that is offered by IP systems. Some interviewees, according to Analysys, referred to the system as acceptable, if antiquated. (The essential function of a number portability process - altering the terminating network of a call - can be achieved in a much simpler fashion on an all-IP network than a circuit-switched network.) It therefore may be more appropriate, as previously mentioned, that a new process is put in place for the porting of numbers from the "076" range. Such a new process could take advantage of technologies such as ENUM and also fully leverage the adaptability of IP.

Q. 7. Do you agree that the existing processes for number portability (for both regular geographic and non-geographic) are adequate, for use in a VoIP context?

Q. 8. Do you consider that a number portability process developed specifically for the "076" range of numbers might be beneficial (i.e. cheaper and quicker) in terms of retaining the inherent flexibility of IP and should be further explored?

6.5 Calling Line Identification (CLI)

In document 04/103, ComReg issued a decision[33] which stated that CLI should only be provided if its veracity can be guaranteed. If this is not the case, then the CLI must be set to "Unavailable". Guidelines to this effect, which have been adopted by ComReg, have been documented by the European Telecommunications Platform (ETP), in Issue 4 of "Guidelines for Calling Line Identifications" [document number (02)51][34].

During the course of the stakeholder interviews held by Analysys Consulting, no parties indicated that there were any technical problems related to VoIP in complying with the existing requirements around CLI. Some interviewees pointed out that there are legitimate reasons for certain consumers (notably commercial ones) wanting wish to display an alternative presentation CLI to that of the actual calling line. An example of this might be a large company wishing to present thte number of the main switchboard, rather than the individual line from where the call is made. ComReg agrees, but notes that this case is not exclusive to the VoIP world and that the CLI shall not be altered as a matter of course. The National Numbering Conventions (NNC) (ComReg document 05/62) specifically states that all authorised persons

> "*shall ensure that the CLI transmitted with a telephone call is the assigned geographic, mobile or IP-based number for the calling party, except in clearly justified cases where permission has exceptionally been given by ComReg."*[35]

[33] Decision 16 of ComReg document 04/103

[34] http://www.etp-online.org/downloads/02_051_CLI_Guidelines_Sep_2002.pdf

[35] Section 3.2.1-5 of ComReg document 05/62

No interviewees have reported any technical problem in following the guidelines (both ETP and the NNC) as they currently stand, although it was noted that altering the CLI in an IP context is a relatively trivial technical issue.

Q. 9. Do you agree that the existing guidelines surrounding the use of CLI are reasonable and technically feasible in a VoIP context? Please give a brief explanation if you disagree.

6.6 Access to Directory Inquiry Services and Directory Listings

Those who offer VoIP as a PATS service are obliged to offer their customers a listing in the National Directory Database (NDD) and also to facilitate directory inquiry and operator assistance services[36]. It is ComReg's belief that these services should also be offered to users of ECS services. Indeed, according to the Universal Service Regulations[37], operator assistance services must be provided by any service provider who offers a service that interconnects with the public telephone network. In the course of the Analysys interviews with stakeholders, both PATS and ECS VoIP service providers stated that they have not experienced or do not anticipate any technical difficulties in providing the aforementioned services to their users. There did appear to be little explicit demand for these services, although it was suggested by some interviewees that this was likely due to the fact that users expect these services as part of a product and do not expect that they might not be provided.

Q. 10. Do you have any particular comments on the topic of VoIP services and the provision of Directory Inquiry and Operator Assistance Services, and Directory Listings?

6.7 Quality of Service and Network Integrity

VoIP services can often have limitations in respect of network integrity and the general quality of service that is experienced by consumers, for example the lack of in-line power for a handset. During ComReg's discussions with stakeholders, many of these expressed agreement that consumers should be aware of these limitations. In a number of cases, consumers were directly referred to ComReg's

[36] Decision 17 of ComReg document 04/103

[37] S21(3) of S.I. 308 of 2003

guidelines[38] so that they could make an informed decision as to the service that was on offer. One stakeholder expressed the view, during the stakeholder interviews with Analysys Consulting, that reliability problems would lessen as the migration to broadband increases and greater bandwidth is more available to the end user.

Providers of ECS VoIP services interviewed generally agreed that quality of service, particularly in relation to voice quality, can be an issue. Two different methods of handling this were mooted, either offering different levels of service for different charges, or offering a rebate for customers who had experienced difficulties.
Providers of PATS VoIP services did not express the view that a lack of quality was an issue. This was particularly the case where service providers had control over the underlying access network.

ComReg has previously advised that it is a condition of allocation for numbers from geographic ranges that customers are advised in their contracts of "limitations of their service … vis-à-vis what those customers might legitimately expect compared with what would traditionally be provided by a PATS service"[39]. This condition applies regardless of the classification of the service which is being provided.
ComReg has made several recommendations on how customers can be informed of these differences, and these are detailed in the "Guidelines for VoIP Service Providers on the treatment of consumers" (ComReg document 05/50).

Q. 11. Do you have any proposals on how the existing guidelines (specifically with relation to quality of service and network integrity issues) could be further clarified or improved to best serve the consumer interest?

[38] ComReg document 05/50

[39] Decision 2(d) of ComReg document 04/103

6.7.1 Port blocking and service degradation

Activities such as port blocking[40] can result in the degradation of the service experienced by VoIP users. Although some stakeholders mentioned that port blocking is an issue that is becoming more prevalent, they also pointed out that this did not currently seem to be a deliberate tactic on the part of the port blockers. Port blocking can take place at the modem used by the user or at any point in either the directly or indirectly connected ISP's network.

Q. 12. Do you agree that the deliberate practices of port blocking or other forms of deliberate service degradation is in principle unacceptable, and if special cases arise then the party carrying out the blocking/throttling must inform the affected parties?

[40] A "port" is an IP subaddress. IP has 36,000 ports; "well-known" port numbers are usually assigned to specific protocols and applications and the other ports are available for use by miscellaneous applications, for example, e-mail, HTTP, Telnet, FTP, and protocols such as SIP. Port blocking and throttling are commonly used as tools to optimise network performance. If however a VoIP service uses one of these "well-known" ports, and this port is blocked, or its service throttled or degraded, this will affect users' ability to use VoIP.

7 Interconnection

7.1 Introduction

There are a number of different types of interconnection used by IP based service providers[41], either involving circuit-switched technology (which can be accurately described as IP – PSTN interconnection) or purely based on IP networks (i.e. IP – IP interconnection). Interconnection already occurs quite seamlessly on a purely IP – IP level, while that between IP – PSTN has been facilitated by ComReg's decision last year to open a new number range (076) for this purpose. As previously discussed, rules have been laid down for tariffs/settlements; number portability, CLI, emergency access etc. in the documents mentioned earlier in this paper, viz "VoIP Services in Ireland" (04/103), "Directions to Enable Opening of Access to VoIP Services based on 076 Number Ranges" (05/23) and "Guidelines for VoIP Service Providers on the treatment of consumers" (05/50).

The existing regimes mean that currently, IP-based telecommunication service providers interconnect with PSTN service providers by means of a gateway, which translates the IP packets to Circuit-Switched traffic. Generally a separate gateway must be provided for each service provider (although aggregation may take place within certain networks). This entails a cost of implementation that, though relatively small, must be borne by VoIP service providers. Additional technical disadvantages may include a degraded quality of service due to fact that several gateways must be traversed with certain call types.

Interconnection on an all-IP level already operates successfully, as mentioned. There are two main methods of interconnection in this context, peering and transit arrangements. Neither of these methods operate on a per-unit transaction cost basis; rather an up-front arrangement is agreed regarding the level of traffic that will be transferred between two parties. Multi-lateral arrangements are also common. If a symmetrical level of traffic will be transferred, then a peering arrangement may be utilised. This is where no billing takes place at all, on the basis that the transaction costs involved would negate any benefit that billing might bring. If an asymmetrical level of traffic is anticipated, then a transit arrangement may be more appropriate. A transit arrangement does involve traditional billing

[41] Interconnection between purely PSTN-based service providers is not within the scope of this paper.

arrangements, though normally on the basis of a flat-rate charge, rather than a per-unit one.

7.2 Existing interconnection arrangements

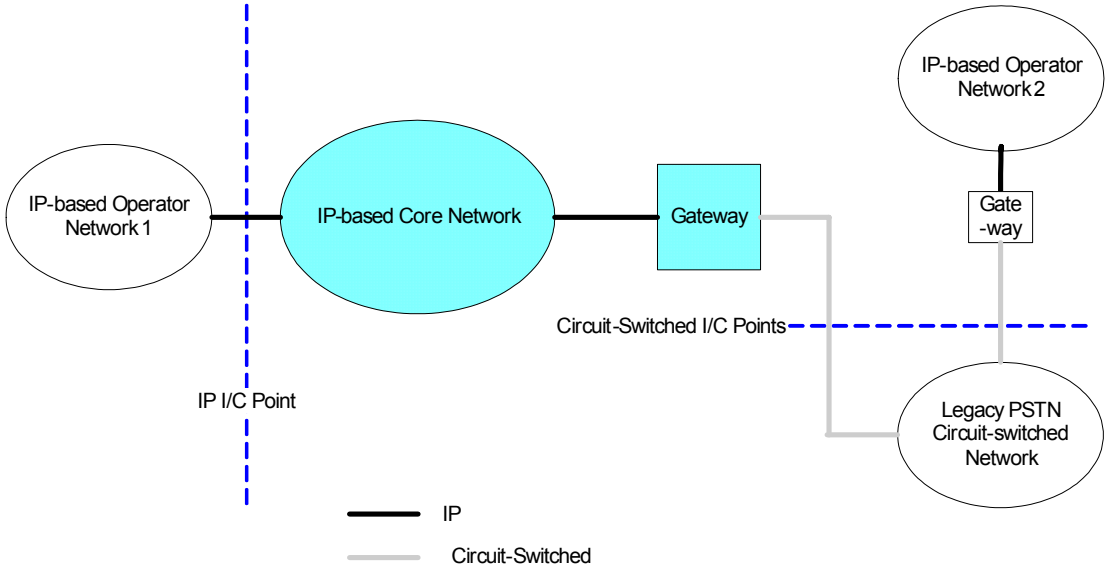

Figure 1: Example of current CS Interconnections between IP services and PSTN

As figure 1 above shows, interconnection between IP services and PSTN services currently occurs within the circuit-switched (CS) sphere, which means that IP SPs must first gateway their products into TDM format. Furthermore, IP providers using the PSTN to interconnect with each other suffer a double gateway-ing process which not only represents additional cost but also loss of quality and potential failure to carry over any added-value services. As direct IP-IP interconnects multiply, this group of IP providers affected in this way is probably decreasing rapidly but nevertheless it is a serious matter for those involved.

Discussions with stakeholders who currently interconnect in this manner show that they do not consider that the costs involved in translating the IP traffic into TDM-compatible traffic to be significant. There did not seem to be any overwhelming desire for a regulated product that would allow service providers to pass on all-IP traffic, without the need for this translation. In any case interconnection with the operator designated with SMP is explicitly regulated, and this is prescribed by a Reference Interconnect Offer (RIO). Interconnection between other parties is normally a matter for commercial negotiation. Those service providers who have been authorised by ComReg to operate publicly available electronic

communications services have the right to negotiate interconnection with other operators.

Therefore should there be a requirement for an all-IP interconnect product between two non-SMP operators, this is likely to be achieved through commercial negotiation. Such a product could have the benefits of reducing the loss of quality and any failure to carry over added-value services, as well as reducing the costs associated with interconnection generally.

Q. 13. Do you believe that there is any requirement at this stage of development in the Irish VoIP industry for commercially negotiated VoIP interconnection products? If so, how would you see this occurring?

7.3 Interconnection arrangements in the Internet world

7.3.1 Peering

Existing public Internet interconnection arrangements typically use a standard peering agreement. This can either be through a public peering mechanism, such as the neutral peering exchanges available in many different countries, or through a private arrangement between two or more internet service providers. In the latter case, the size of an ISP will dictate the bargaining power that they can leverage in negotiating independent peering arrangements with others. Smaller ISPs are generally unable to gain access to these types of arrangements and therefore are more visible as members of neutral exchanges.

The elements that are generally decisive in factoring whether an ISP 'carries enough weight' to negotiate a peering arrangement include its size, reach and quality of its IP backbone network and its ability to interconnect at an appropriate point in the other's network. Other relevant elements include the speed of access required, potential utilisation, and quality of services and whether or not these can be guaranteed.

Neutral exchanges (such as INEX in Ireland or LINX in London) provide central interconnection hubs where members have the option of peering with each other. This allows members to have the benefits of multi-lateral peering arrangements without the associated costs of implementation. Members of neutral exchanges can

sometimes have the option of refusing to peer with other members; the exchange merely offers the facility by which members can peer. There is also no obligation on any one member to accept traffic from all other members. Usually however, members do accept each others traffic and INEX members, for example, are required to engage in a minimum level of peering. Neutral exchanges are generally non-profit making organisations and are run by their members, for their members.

Commercial neutral exchanges, such as XchangePoint Europe (XPE) or Equinix Internet Business Exchange (IBX) also exist, and these are profit-seeking organisations. These commercial exchanges typically offer a wider portfolio of products[42] to their customers than the "ordinary" neutral exchanges, and have fewer restrictions in terms of access. The suite of products offered by these commercial exchanges is currently considered to be discretionary and therefore not considered to be within the remit of the "ordinary" neutral exchanges. They are still considered to be neutral as they generally do not compete with their customers.

7.3.1.1 VoIP Peering trial

INEX is currently running a VoIP peering trial, which involves peering at a higher level in the application layer model, and implies simultaneous interconnection on three separate planes (or layers):

- The **IP** plane: This is a traffic exchange interconnection, using Internet Protocol (IP), in which packets of data are transferred over the communications link (fibre/wireless/copper/cable/satellite ….) between the two sides, without reference to the (voice payload) content of the packets.;
- The **Media** plane: This is the application layer, in which the particular application being used is voice[43]. Addressing VoIP-VoIP interconnection means one is paying attention to the actual characteristics of the voice messages being transferred, rather than just IP packets;
- The **Control** plane: This is a session-layer interconnection in which attention is paid to the details of setting up and tearing down the 'call' or session. Various protocols deal with this, such as the ITU-T's H.323 or the IETF's (more popular) newer SIP. (Skype, GoogleTalk and other such P2P applications typically use a proprietary form of SIP, rather than the standardised version.)

[42] XPE for instance offers a range of public peering, VoIP peering, IP transit, private interconnection products, protocol conversion, global POPs, ENUM, SPIT protection etc. See www.xchangepoint.net.

[43] An alternative type of medium could for example be video, in which the particular protocols used would be different to those used for voice.

This technical trial is currently ongoing, and it is therefore as yet too early to draw any concrete conclusions or outcomes from it.

7.3.2 Transit arrangements

Transit interconnection arrangements in the context of the public Internet are different from peering arrangements in that they involve a separate charge for traffic. This type of arrangement generally applies if the ISP involved is not significant enough (i.e. is too small, cannot handle sufficient capacity or has too few Point-of-Presences (POPs)) to warrant a peering arrangement with another ISP.

Some neutral Internet exchanges also offer IP transit products and act as a clearing house for the interconnecting parties. One advantage of using an exchange rather than negotiating an independent agreement with an individual transit partner is the availability of many potential partners, at probably better terms.

In general, transit fees take the form of a flat-rate charge, based on the capacity of the link, rather than the actual traffic passed. The actual interconnection link must also be paid for, and who pays for this is based on the form of transit used. The forms of transit are somewhat analogous to the PSTN in that both far-end and near-end transit (similar to far-end handover and near-end handover in the PSTN) exist. In the former case, the operation of the actual transit link is the responsibility of the requesting party. In the case of near-end handover, the providing party, for an extra charge, supplies the link.

Q. 14. Do you believe that the current IP interconnection arrangements are satisfactory? Are there any areas which you believe would benefit from further development? If so, please give a brief description of these.

8 Future Work

ComReg has taken a very pro-active role in relation to VoIP and the introduction of VoIP services into Ireland. The availability of both geographic and non-geographic numbers for these services has enabled the initial migration of users from the PSTN to VoIP. ComReg will continue to monitor the Irish VoIP market, together with other national and international developments in the IP world. Of particular interest will be standards relating to those obligations detailed in the Universal Service Regulations as they are ratified and released. ComReg will also monitor and take account of other international developments, such as any specific guidance on matters relating to VoIP issued by the European Commission, as well as other bodies such as the ITU, IETF, OECD, and IRG/ERG etc.

Other elements that could impact on this existing VoIP framework are the upcoming review of the 2003 Regulatory Framework by the European Commission, and the ongoing market review process.

Although ENUM does not come into the scope of this document, it is worth noting here that since the completion of the Irish ENUM Trial in 2005, steps are now ongoing to commence the commercial phase of ENUM in Ireland. As ENUM is a potential driver for the uptake of VoIP services, it is likely that this development will be of interest to those service providers. It is possible that ENUM also has a role to play in the evolution of number portability processes.

Technological changes in the telecommunications industry may also necessitate a review of this initial framework. These changes are likely to include migration towards all-IP-based networks, including Next Generation Networks (NGNs), together with the adoption of alternative access networks such as Wi-Fi or WiMax.

ComReg encourages interested industry members to discuss these issues together, that they might better understand the impacts these technologies might have on all aspects of their business models and how they might affect their future evolution in the marketplace. This could be achieved by the formation of a body to represent and communicate the interests of members to policy makers, the wider business community and the various consumer bodies.

Finally, it may be appropriate that ComReg document 05/50 (Guidelines for VoIP Service Providers on the treatment of consumers) is updated, depending on the outcome of this consultation paper.

Q. 15. What further measures could VoIP service providers and/or ComReg undertake in order to increase consumers' awareness of the "076" number range, and the benefits, limitations and related issues associated with VoIP services?

9 Submitting Comments

All comments are welcome; however it would make the task of analysing responses easier if comments were referenced to the relevant question numbers from this document.

The consultation period will run from 3rd March to April 13th 2006 during which the Commission welcomes written comments on any of the issues raised in this paper.

Having analysed and considered the comments received, ComReg will review the VoIP Framework and publish a report in May on the consultation which will, inter alia summarise the responses to the consultation.

In order to promote further openness and transparency ComReg will publish all respondents' submissions to this consultation, subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24. We would request that electronic submissions be submitted in an-unprotected format so that they can be appended into the ComReg submissions document for publishing electronically.

Please note

ComReg appreciates that many of the issues raised in this paper may require respondents to provide confidential information if their comments are to be meaningful.

As it is ComReg's policy to make all responses available on its web-site and for inspection generally, respondents to consultations are requested to clearly identify confidential material and place confidential material in a separate annex to their response

Such Information will be treated subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24.

Appendix A – Legislation

Framework Regulations means the European Communities (Electronic Communications Networks and Services) (Framework) Regulations, 2003 (S.I. No. 307 of 2003).

Universal Service Regulations means the European Communities (Electronic Communications Networks and Services) (Universal Service and Users' Rights) Regulation, 2003 (S.I. No. 308 of 2003).

In accordance with the terms of Regulation 22 of the Framework Regulations, ComReg is vested with the responsibility for administering the national telecommunications numbering resource, while under Regulation 14 of the Authorisation Regulations; ComReg has a statutory obligation to define conditions to be attached to rights of use of numbers.

Appendix B – Consultation Questions

List of Questions

Appendix C - Acronyms

CLI (Calling Line Identifier) is a facility that enables identification of the number from which a call is being made.

CPS (Carrier Pre-Selection) is the facility offered to customers which allows them to opt for certain defined classes of call to be carried by an operator selected in advance (and having a contract with the customer), without having to dial a routing prefix or follow any other different procedure to invoke such routing. The CPS operator need not be the access provider.

DDI (Direct Dial In) is a switchboard's capability to route an incoming call to the extension dialled without the intervention of an operator.

E.164 Standard is an ITU-T standard that defines the international public telecommunication numbering plan.

ECN (Electronic Communications Network) means transmission systems and, where applicable, switching or routing equipment and other resources which permit the conveyance of signals by wire, by radio, by optical or by other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including Internet) and mobile terrestrial networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable television networks, irrespective of the type of information conveyed.

ECS (Electronic Communications Service) means a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission services in network used for broadcasting, but excludes:

(a) A service providing, or exercising editorial control over, content transmitted using electronic communications network and services; and

(b) An information society service, as defined in Article 1 of Directive 98/34/EC, which does not consist wholly or mainly in the conveyance of signals on electronic communications networks.

ENUM (Electronic NUMbering or alternatively tElephone Number Mapping) is a protocol for converting an ordinary telephone number into a format that facilitates Internet-based look-up of any kind of addressing information.

ETP (European Telecommunications Platform) is a body that deals with the needs of the European telecommunications market from the point of view of industry. Its remit includes: the European regulatory framework, its implementation, the converging communications sector, and the global information society.

IETF (Internet Engineering Task Force) is the Internet standardisation body.

ISP (Internet Service Provider) provides Internet service to consumers.

MNA (Minimum Numbering Area) is a defined geographic area that is equal to or one of a few subdivisions of an STD area. Location portability (of geographic numbers) may not extend beyond an MNA's boundaries, for practical (PSTN-oriented) reasons.

NDD (National Directory Database) is a record of all subscribers in the state, including those with fixed, mobile and personal numbers, who have not refused to be included in that record.

NNC (National Numbering Conventions) is the set of rules under with the Irish National Numbering Scheme is managed and administered. It includes the conditions of use for different number types.

NP (Number portability) between operators enables a customer to transfer from one operator to a second operator, while retaining the same number provided the customer remains at the same address or at least within the same MNA. *Note GNP refers to Geographic NP and NGNP to Non-geographic NP.*

NRA (National Regulatory Authority) is the relevant regulatory authority in each country. In Ireland, the NRA is ComReg.

PATS (Publicly Available Telephone Service) means a service available to the public for originating and receiving national and international calls and access to emergency services through a number or numbers in a national or international telephone numbering plan, and in addition may, where relevant, include one or more of the following services: the provision of operator assistance, directory inquiry services, directories, provision of public pay phones, provision of service under special terms, provision of special facilities for customers with disabilities or special social needs or the provision of non-geographic services or both.

POP Point of Presence is a facility where the local telephone exchange, switch, transmission equipment, etc. is located.

Port Blocking A "port" is an IP sub-address. IP has 36,000 ports; "well-known" port numbers are usually assigned to specific protocols and applications and vice versa, for example, e-mail, HTTP, Telnet, FTP, and protocols such as SIP (Session Initiation Protocol) used by VOIP. If a VoIP service uses one of these "well-known" ports, and this port is blocked, this will affect users' ability to use VoIP.

Public Telephone Network (PTN) means an electronic communications network which is used to provide publicly available telephone services; it supports the transfer between network termination points of speech communications, and also other forms for communications, such as facsimile and data.

Public Switched Telephone Network (PSTN) means **t**he telecommunications networks of the major operators, on which calls can be made to all customers of all PSTNs.

SMP (Significant Market Power) The Significant Market Power test is set out in various European Directives, including the Interconnection Directive, the Amending Leased Lines Directive and the Revised Voice Telephony Directive. It is used by the NRA to identify those operators who must meet additional obligations under the relevant directive. It is not an economic test; rather it requires a consideration of the factors set out in the test within a specified market.

STD (Subscriber Trunk Dialling) is another term for NDC (National Destination Code), without any dialling prefix (e.g. '0').

TDM (Time-Division Multiplexing) is a method of putting multiple data streams in a single signal by separating the signal into many segments, each having a very short duration. Each individual data stream is reassembled at the receiving end based on the timing.