



Commission for
Communications Regulation

Consultation Paper

ENUM: Accessing Multiple Customer Services Through Telephone Numbers

Document No:	03/36
Date:	26, March 2003

All responses to this consultation should be clearly marked:-
“Reference: Submission re ComReg 03/36” as indicated above,
and sent by post, facsimile or e-mail, to arrive on or before
5:00 p.m., Friday 2 May 2003, to:

FREEPOST
Mr. Pat Walsh
Commission for Communications Regulation
Irish Life Centre
Abbey Street
Dublin 1
Ireland

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

Contents

1	Foreword [by the Chairperson]	2
2	Introduction	3
3	Briefing Note	4
3.1	WHAT IS ENUM?	4
3.2	THE ADVANTAGES OF ENUM	6
3.3	ISSUES SURROUNDING ENUM	7
3.3.1	<i>General</i>	7
3.3.2	<i>Data Confidentiality</i>	7
3.3.3	<i>Identity hi-jacking</i>	8
3.3.4	<i>Demand for numbers</i>	8
3.3.5	<i>Monopoly Positions</i>	9
3.3.6	<i>International control of ENUM</i>	9
3.3.7	<i>Parallel ENUMs and Parallel Registrations</i>	10
3.4	NATIONAL IMPLICATIONS OF ENUM	11
3.4.1	<i>Role of the Dept. in respect of ENUM in Ireland</i>	11
3.4.2	<i>Role of ComReg</i>	11
3.4.3	<i>Delegation of Tier 1/2 functions to 'neutral'/non-profit 3rd parties</i>	11
3.4.4	<i>Should Ireland participate in ENUM at this stage (e.g. trials)? Or at all?</i>	12
3.4.5	<i>Which entities should participate in Irish ENUM? How will they interact?</i>	12
4	History and Current Status of ENUM	14
4.1	HISTORY	14
4.2	THE CURRENT STATUS OF ENUM	14
5	Activities elsewhere, including Trials	16
6	Proposed Irish Approach to ENUM	18
7	Consultation Questions	20
7.1	QUESTIONS ON GENERAL ISSUES SURROUNDING ENUM	20
7.1.1	<i>Data Confidentiality & hijacking</i>	20
7.1.2	<i>Demand for E.164 Telephone Numbers</i>	20
7.1.3	<i>Parallel ENUMs and Usage of E.164 Numbers</i>	21
7.1.4	<i>E.164 Number Types Permitted to Register</i>	21
7.1.5	<i>To Participate Now, or Not?</i>	22
7.2	QUESTIONS SPECIFIC TO A TRIAL	23
7.2.1	<i>Monopolies and the Players within an Irish ENUM System</i>	23
7.2.2	<i>Architecture of an Irish ENUM Trial</i>	24
7.2.3	<i>Irish ENUM Entities for Trial Purposes</i>	25
7.2.4	<i>Measuring Interest in an ENUM Trial</i>	25
8	Submitting Comments	28
	Appendix 1: Relationships within ENUM	29
	Appendix 2: Basic Principles to follow in an ENUM implementation	36
	Appendix 3: References	37
	Appendix 4: Definitions & Abbreviations	38

1 Foreword

This consultation paper describes the emerging new ENUM protocol which facilitates convergence between the traditional telecoms world and the Internet world and which can open new opportunities for innovative Irish enterprises, either as service providers for the ENUM infrastructure itself or else as developers of services that leverage the information bases provided by ENUM. The paper suggests a possible Irish approach to ENUM and it also describes a wide range of issues that arise in respect of ENUM. As such, it forms an information source for those who are new to ENUM or unaware of its possibilities, but who nevertheless have some familiarity with common communications terminology.

However, this is primarily a consultation document that seeks to identify the wishes and needs of potential players in the Irish ENUM market, or even those with just an interest in the subject. The results of the consultation will help to guide ComReg on its way forward in respect of ENUM, at national level and in responding to the ENUM issues that are now starting to arise in various fora. In particular, the consultation will help to identify whether a national ENUM trial should be undertaken and in what format.

ENUM impinges on areas that are of concern to various Irish organisations and I am particularly keen to receive the views of those bodies to ensure that a unified way forward is found. The Department of Communications, Marine & Natural Resources is the body responsible for notifying the ITU-T to whom the Irish ENUM Tier 1 delegation may be made and without such notification ENUM implementation cannot take place. ComReg itself holds responsibility for the Irish numbering scheme, including all the E.164 telephone numbers which form the basis of ENUM and has concerns that ENUM implementation should not negatively impact the numbering scheme. ISPs and other Internet-based bodies have an interest in ENUM because this is a scheme that introduces a DNS¹ approach to facilitating electronic communications. Telecoms operators, SPs, ISPs and entrepreneurs might see opportunities to increase traffic (in the former case) and/or to expand their offerings into new areas in the more converged world that ENUM represents.

ENUM is currently at a point where a great deal of exploration of its possibilities is going on and it is unclear whether the outcome of this will be a gradual loss of momentum and interest or a sudden surge that will result in clear long-term winners and losers. I am anxious that Irish players have the maximum opportunity to participate and make their own informed decisions on this matter. I therefore look forward to the results of this consultation with special interest.

Responses to this consultation document will be accepted up to 2, May 2003 and a Response to Consultation will be issued in June 2003.

Etain Doyle,

Chairperson, Commission for Communications Regulation

¹ The Domain Name System is *inter alia* a hierarchical structure of databases that provide a mechanism to allow the corresponding IP address to be found for every Internet Domain Name, thus allowing Domain Names to be used as practical (albeit indirect) addresses.

2 Introduction

ENUM is an addressing protocol that enables a range of communications mechanisms to be identified for a participating customer by mapping that customer's telephone number into the Internet domain name system, using a simple algorithm defined by the IETF².

ENUM, if widely taken up, potentially offers a mechanism to contact anybody, anywhere, on the communications terminal and using the communications service that is most efficient or convenient for both parties.

This consultation document provides a brief introduction to ENUM, outlining the technology, the issues surrounding it and how they may be resolved. It then discusses approaches towards the successful national implementation of ENUM and poses a series of questions whose answers may help to guide national ENUM players in deciding their way forward. It is aimed at those who have at least a basic knowledge of Internet and communications issues and can therefore understand the terminology involved.

² Internet Engineering Task Force, the technical body that develops Internet standards.

3 Briefing Note

3.1 What is ENUM?

Much has been spoken and written about telecommunications “convergence”, in the context of the growing support by the Internet for traditional telecoms services as well as the steady growth of support by the PSTN/ISDN for IP capabilities - typically in the form of transport and access mechanisms (See REFs 2 & 3 for discussions on this). ENUM³ is a key Internet DNS-based emerging protocol, supported by its own architecture of databases, that specifically targets the convergence of these two distinctive worlds. Put simply, ENUM allows one to type a standard telephone number⁴ into a Web browser (or similar tool) and receive back the number-holder’s email address, Web URL or other data that can be used to contact the number-holder. This data can also show that person’s preferred means of contact, facilitating connection using the cheapest or most effective or most efficient means available – for example IP telephony if it is available, or fax in the case of simple page-image transfer.

Using ENUM, a single user telephone number can be the gateway for routing callers to any selected one of a variety of addresses belonging to the called party, including those used for phone (standard/mobile/VoIP), fax (standard or IP), e-mail or multimedia (e.g. SIP⁵) and others. The list of contact addresses can be amended, added to, or updated without changing the telephone number used for access. **Figure 1** below shows schematically what happens when an ENUM-based IP telephony call is made, including querying of the ENUM databases, identification of the called party’s preferred means of access (for IP calls) and her address, and then automatic completion of the call. As **Figure 1** shows, the first essential step in the ENUM process is to reverse the entire internationally formatted telephone number, inserting a period after each digit, and then to add “e164.arpa” at the end. This effectively converts the telephone number into an internet DNS domain, under the .arpa root. The well-established process of DNS querying then follows, but to special ENUM registries rather than the regular DNS name servers. The result is also different, as it is not an IP address that is returned but rather a special record known as a NAPTR¹¹ resource record, containing all (electronic) contact addresses that the relevant number-holder wishes to make known (Note: **Figure 1** only shows the part of the response needed for an IP telephony communication, but any other types of addresses stored by the customer would also be returned).

³ ENUM is said to stand for Electronic Numbering, though other suggestions that have been made include tElephone NUmber Mapping, e164 Number Mapping, tElephone Number – URI Mapping, Enhancement of NUmbering and naMing.

⁴ Known as E.164 numbers, after the ITU-T Recommendation E.164

⁵ SIP = Session Initiation Protocol. SIP is an emerging signalling protocol for Internet conferencing, telephony, presence, events notification and instant messaging. The protocol initiates call setup, controls routing, authentication and other signalling for IP communications.

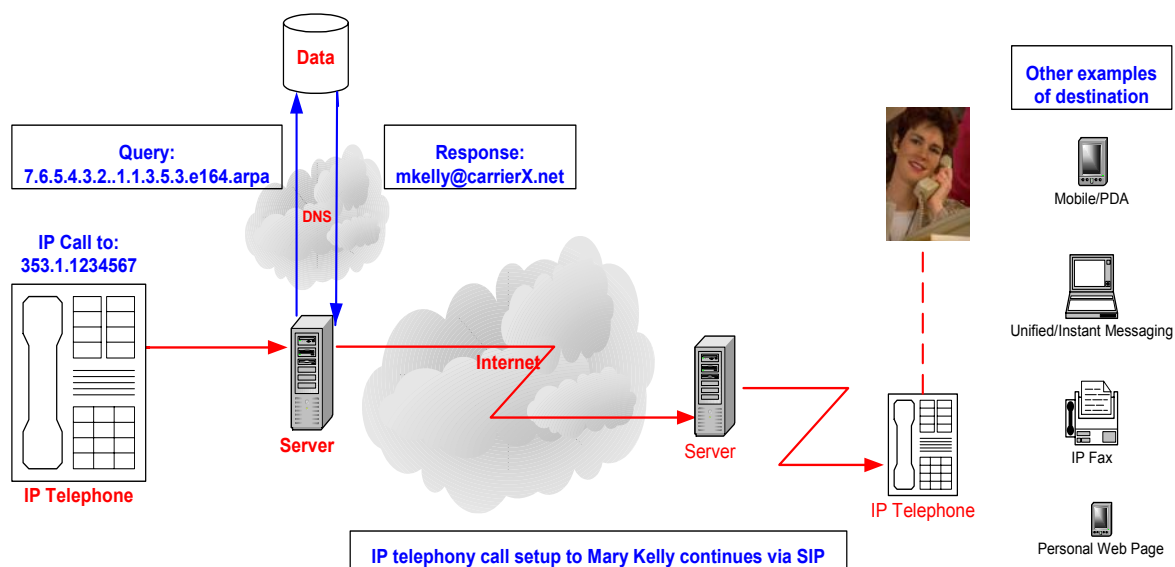


Figure 1: Example of an IP-telephony call using ENUM

ENUM, which is some 2½ years old⁶, has been developed by the Internet body IETF⁷, with the Internet Architecture Board (IAB) and the ITU-T subsequently getting heavily involved in its management, administration and architecture side. Today, the standards for ENUM are virtually complete and significant progress has been made towards bringing the system into being as a public service but progress appears to have temporarily slowed for reasons outside of the protocol itself or its capabilities. These brakes on progress spring from uncertainties related to how national and international bodies will implement the protocol at a practical level. No such constraints exist at the totally private level and some “private ENUMs” have already been set up, with trial or real customers already in place in these. These parallel efforts – which for the moment only exist in the USA - are striving to grow fast before a full integrated public service gets underway, which could make their own offerings less attractive. They may affect growth levels of public ENUM, at least in their own countries, if they achieve a sufficiently large base of users at an early stage. Private ENUM systems are of use to very large organisations, especially those with diverse subsidiaries operating separate IT systems in one or multiple countries.

ENUM has two end-users, the calling party (as described above) and the called party who is the telephone number-holder and who pays whatever ENUM subscriptions may be levied. Figure 2 below shows typical⁸ ENUM relationships, which are structured under the Internet “Arpa” domain, while Figure 4 shows where Arpa and ENUM themselves fit into the wider picture.

⁶ It entered the Standards track in the IETF in September 2000.

⁷ IETF = Internet Engineering Task Force

⁸ There are many other possible sets of inter-relationships.

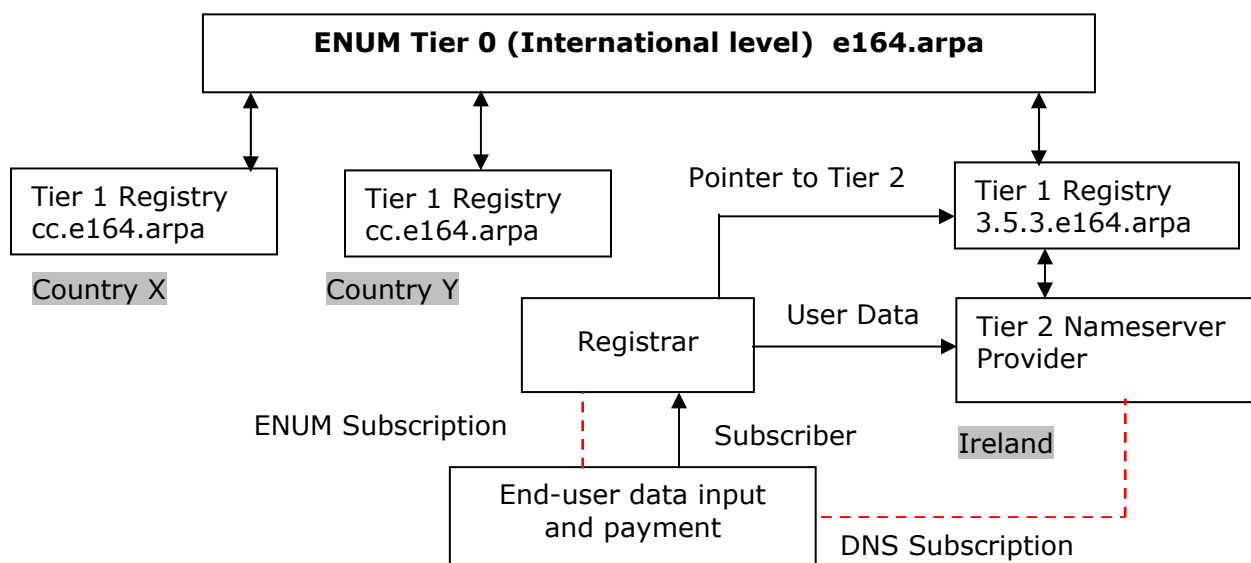


Figure 2: Typical ENUM relationships from the subscriber perspective

3.2 The advantages of ENUM

Armed only with somebody's telephone number, anyone can quickly perform an ENUM look-up that returns a range of alternative mechanisms to contact the person in question. Because the data returned by the system includes alphabetical characters, the lookup would normally be initiated from a suitable terminal⁹ that can display (and input) such data as email or SIP address or web URL. With this information, the caller can decide how best to contact the number-holder; for example, if the caller is using an IP phone and the returned NAPTR records show the number-holder also has IP telephony, then a direct IP call can be initiated at little or no cost.

It is therefore feasible for the standard telephone number to become the sole contact mechanism shown on business cards, headed notepaper etc.

It also becomes possible on the one hand for someone to indicate his/her preferences among the methods of communication that will work and, on the other hand for a caller to select the means of contact from these choices according to his/her own possibilities.

The combination of ENUM and IP telephony is especially powerful and standardisation of the SIP⁵ protocol in parallel with ENUM is opening the door to rapid progress in respect of both of these protocols. A SIP-enabled terminal could initiate a call to someone's phone number and if SIP (or other IP telephony mode) is possible, automatically set up such a cheap (or free) call and if not – rapidly and

⁹ This could include PCs, mobile/cordless phones, IP phones and various data terminals. See ComReg document 03/21 for information on IP telephony (VoIP) and SIP.

quite transparently to the caller – proceed to initiate a normal phone call that only moves onto the PSTN at the nearest SIP gateway to the called person.

It is important to understand that while ENUM opens the door to automating and supporting a whole range of communications mechanisms, the ENUM protocol itself is restricted to providing addresses and related data for communicating with any registered number holder anywhere in the world, when that person's E.164 telephone number is entered.

3.3 Issues surrounding ENUM

3.3.1 General

The introduction of ENUM is likely to result in additional complexity in commercial relationships and in regulation of the telecommunications sector, due to the large linked databases and complex sets of relationships that would result. "It is likely that both regulators and telephony service providers will face challenges from the quantum changes to the familiar telecommunications market structure and behaviour that ENUM may facilitate" [REF 5]. This may be ameliorated within the European environment by a co-ordinated approach. Policies governing the operation of the various ENUM entities at all levels remain to be copper-fastened, although basic agreements are already in place at international level. However, issues about who should administer and operate ENUM at national level still need to be made in most countries (i.e. interplay of Governments, NRAs, Internet ccTLD registrars, telecoms operators and ISPs). This is discussed below in this chapter, and later in the document.

3.3.2 Data Confidentiality

ENUM is based upon DNS storage (under the gTLD¹⁰ ".arpa") within large database registries of sensitive contact information about its end-users. Once someone starts to offer such a registry service (including Nameservers for delivery), there is no reason why they should not also seek out additional opportunities by including extra information about their customers (i.e. end-users). Clearly handling of personal contact information itself raises important data confidentiality issues, while the more information that is included, the more difficult these issues become. Any communication attempt to an E.164 number that involves an ENUM look-up will enable the requesting party to access information on all of the service-specific communication identifiers contained in that person's ENUM record¹¹ (e.g. telephone numbers, fax numbers, email addresses, Web URL, Instant Messaging addresses, etc). Among various abuses¹² that could arise from this, perhaps the two most obvious are that:

- spam lists could potentially be built up fairly easily, crossing a whole range of communications mechanisms, if controls are weak; and

¹⁰ gTLD = generic Top Level Domain (e.g. .com, .net, .biz), whereas ccTLD = country code TLD (such as .ie, .uk, .ch).

¹¹ These are known as Naming Authority PoinTeR (or NAPTR) Resource Records.

¹² As a DNS query under .arpa – like a query under any other DNS TLD - can be made from anywhere in the world, the potential for abuse is increased accordingly.

- end-users can be subjected to nuisance calls from Service Providers (SPs) who can readily identify or deduce which services are in use by the user and (in some cases) who is currently providing them.

A first major step towards answering these problems was taken when it was agreed within IETF that ENUM should be an opt-in service i.e. telephone number-holders must ask, or at least agree, to have their data included in the ENUM system, rather than have it automatically entered by someone¹³. This choice of opt-in as default nevertheless raises some concerns as to the likely success of ENUM, as it reduces the likelihood of an ENUM look-up successfully returning NAPTR records for any particular queried telephone number – at least in the short-medium term.

Data concerns are still likely to arise where organisations enter data en-bloc for their personnel or members¹⁴, though whether this falls foul of legislation may depend on the specifics of each case.

3.3.3 Identity hi-jacking

Another identified issue for ENUM is the risk that implementations of ENUM that do not have adequate control or supervision could result in database entries in which users pass themselves off as others or if unscrupulous network operators or providers of communication applications or services insert themselves in the communications path to an end-user, without that end-user's permission (the latter, resulting in unexpected bills to the user, is known as hi-jacking). Avoidance of the former is by implementation of proper authentication for registry entries while problems with the latter are best managed by careful regulation.

The same level of care is needed for private ENUMs and for all interconnection cases involving them, as additional complexity arises because it is necessary for each side to ensure that the other party has acted equally diligently.

3.3.4 Demand for numbers

ENUM can be used with non-geographic as well as geographic or mobile numbers (e.g. a user may enter his/her Freephone number as readily as his/her Dublin or Cork number) – subject to NRA agreement on this. It requires no change to national numbering plans and should not of itself bring additional difficulties or additional demand for E.164 number resources, though it needs to be considered if specific changes are needed to national numbering rules. However, new services and applications triggered or encouraged by the availability of ENUM could generate additional demand for numbering resources. For example, Service Providers offering pure IP services, which have no intrinsic need for telephone numbers, might see an advantage in acquiring a “free” add-on directory service via ENUM for their users simply by “justifying” the need for a unique access telephone number for each of those users.

¹³ Considering that the ENUM registries are effectively directories, this approach is consistent with Article 8 (Directories of Subscribers) of S.I. No 192 of 2002: “European Communities (Data Protection and Privacy in Telecommunications) Regulations 2002 and also with Article 12 (Directories of Subscribers) of Directive 2002/58/EC (Directive on privacy and electronic communications), which comes into force on 31 October 2003. Both of these would ensure that the type of information stored by ENUM can only be included with explicit user consent.

¹⁴ This may happen particularly in the case of private ENUM systems, within large companies.

The risk of this kind of unexpected consequence of ENUM is not quantifiable and is assumed to be small for the immediate future, in line with the still-low penetration of IP services into the traditional telecoms world. However, if some new innovative IP service were to appear which could fully avail of ENUM to reach the great mass of ordinary telecoms users, then a snow-balling impact on demand for number resources might arise unexpectedly.

3.3.5 *Monopoly Positions*

ENUM operates through a hierarchical series of registry functions, analogous to the existing well-known DNS system and actually as a part of that system under the “.arpa” gTLD. The highest level¹⁵, Tier 0 (i.e. “.arpa”), is controlled internationally – see next section, below. Under this, the Tier 1 registry and possibly the Tier 2 Nameserver Provider function are natural monopolies which impact the whole operation of ENUM within a country. This carries risks of unfair charges, or undue administrative or other burdens being applied (even under non-profit arrangements). Even in cases where these functions may not themselves be commercially attractive, it seems important for them to be carefully regulated to avoid unfair impositions (or discrimination) damaging the service. Tier 1 management (not shown separately in Figure 2, to aid visual clarity) represents the overall administrative control of ENUM at national level, and must ensure that such abuses cannot occur.

The Tier 2 of ENUM is where the key end-user records are stored and processed and therefore this, along with the Registrar function, is where most commercial interest lies and where the greatest scope for problems arises. As indicated, there are two obvious Tier 2 services that can be offered; the Tier 2 Nameserver Provider(s) (i.e. data delivery function) and/or the Registrar function, which is basically the service of validating customers and entering their data into the Tier 2 Nameserver registers¹⁶. These two functions could in principle be offered by the same entity (i.e. a Nameserver provider may wish to offer ENUM registration services directly to its own customers in competition to independent Registrars) but this might not be considered pro-competitive if the number of players in those fields is small. Clearly the relationships between SPs interested in providing ENUM customer services and the Nameserver Provider(s) is a commercially sensitive one and is open to abuse as there are unlikely to be many Tier 2 Nameserver Providers.

3.3.6 *International control of ENUM*

Whether it is appropriate to keep ENUM within the Arpa domain which is under the control of one country - the USA - has been the subject of much international discussion. An obvious alternative that has been put forward is to use some other TLD (e.g. “e164.int”, signifying “international”) but the fact that “e164.arpa” is already written into IETF RFC 2916 generates a certain inertia against change. At this stage, the ongoing use of “.arpa” seems to be a near certainty.

¹⁵ This section only deals with public ENUM; the hierarchy of private ENUMs and the degree to which they are permitted to link to and inter-work with the public system, if at all, is dependent on decisions made at national level.

¹⁶ The Registrar may also be responsible for simultaneously updating the Tier 1 register with the corresponding pointer to Tier 2.

3.3.7 *Parallel ENUMs and Parallel Registrations*

An alternative, feasible approach to the straight-forward hierarchical ENUM Tree (known as “The Golden Tree”) is for multiple parallel competitive ENUM DNS zones to be deployed in some TLDs¹⁷. Such a policy can resolve the monopoly issue (at a high cost in terms of considerable additional signalling complexity between the various parallel domains), but there is then a much stronger need to ensure adequate safeguards and controls to ensure consistency, cohesion and adequate protection of the multiple data streams that result. This approach, in terms of public ENUM, is receiving little support outside of the USA, where it has some strong backers, as the threats are considered to far outweigh any perceived benefits. In a small country like Ireland there seems to be little logic in diverting from the single ‘golden tree’ approach. Indeed, as populating the same telephone number into multiple parallel DNS domains goes against the basic approach of the global DNS system of storing any given domain name in one and only one location on the DNS tree, it should be a basic requirement of ENUM administration in Ireland that if parallel trees exist a holder of an Irish (E.164) telephone number may only enter that number into a single tree¹⁸.

There **do** seem to be two mechanisms under which subscribers might be able to simultaneously have public ENUM registrations under more than one system of national control; albeit using different telephone numbers. ENUM is basically tightly linked to E.164 numbers, so at first glance it seems that the total system lies under the control of national administrations. However, (partial or full) country codes have been allocated under ITU-T to certain very large networks¹⁹, and telephone numbers allocated under such codes are eligible for ENUM registration under these – perhaps to entities that already hold “real” nationally allocated numbers. Likewise, holders of international non-geographic numbers (e.g. international Freephone numbers or UPT Personal Numbers) are eligible to register under the appropriate international global service code in respect of these. If someone is registered in ENUM under a national jurisdiction and also under an international network code or global service code then that person would have two separate sets of contact “identities”; it isn’t immediately obvious if any practical or security issues arise from this.

¹⁷ Certain commercial actors are pressing hard for this approach to be used, especially in the USA. Such domains would exist in parallel with the “.arpa” ENUM tree and to avoid DNS queries addressing the Internet Root Node, would need multiple lower-level linkages, thereby breaking the overall tree structure.

¹⁸ In other words, if an Irish telephone number is entered into the single public “353” ENUM Tier 1 Registry, it should be a condition of use that it may not also be entered into any other public ENUM system or any private system with links to the public system, to avoid risk from current or future linkages between that system and the global public ENUM.

¹⁹ In respect of international networks, BT, among others, has such an allocation.

3.4 National Implications of ENUM

ENUM deals with standard E.164 telephone numbers of all kinds, although restrictions may be placed on the use of certain non-geographic numbers for this purpose (e.g. Premium Rate Numbers).

In addition, as ENUM is a new technology, it is worth noting the roles that different organizations might play in this country, as discussed in the next sections.

3.4.1 Role of the Dept. in respect of ENUM in Ireland

The Department of Communications, Marine and Natural Resources is the national representative body for Ireland under ITU-T and therefore is the body which would notify to ITU-T to whom the 353 Tier 1 Registry may be delegated; without such authorisation practical implementation of (public) ENUM cannot proceed in Ireland.

3.4.2 Role of ComReg

ComReg manages the Irish National Numbering Scheme, which includes the whole E.164 numbering resource that is the foundation on which ENUM is built. Ongoing choices about which number types are suitable for ENUM, validation of users and their (current) rights in respect of numbers submitted to ENUM, and the general resolution of problems that can arise from the usage of numbers in ENUM (e.g. national number changes, ceased/withdrawn numbers and ported numbers) should fall to ComReg to resolve. The Tier 1 Manager function (i.e. administrative oversight) is perhaps an obvious role for ComReg, which would mean administrative regulation of the Tier 1 Registry and also oversight of the Tier 2 functions (Nameserver and Registrar). At the same time, as ComReg is a non-commercial body it should not be directly involved in the Tier 2 functions, except perhaps in respect of their regulation. While direct technical operation of the Tier 1 Registry is a further possible function for ComReg, if necessary, it is probably more practicable for this function to be carried out by a more commercial entity (see next section, below).

3.4.3 Delegation of Tier 1/2 functions to 'neutral'/non-profit 3rd parties

The Tier 1 Registry functions are basically those of Tier 1 Manager and (normally separately) Tier 1 Registry technical operator (See Figure 4). The Tier 1 Manager function is the entity to which responsibility for the domain "3.5.3.e164.arpa"²⁰ is delegated by RIPE. The Manager oversees operation of the ENUM system, insofar as it sets down the rules by which both Tier 1 and Tier 2 registries operate. The Manager could also be the operator of one or both of these registries, though separation of manager and technical operation functions seems to be desirable to ensure the system develops in the overall national interest. For the purposes of a potential Irish trial, it needs to be decided whether ComReg (as suggested in 3.4.2 above), or the Department, or some other non-profit independent entity would act as Manager or if these sensitive roles can be fulfilled by commercial players.

For subsequent full commercial operation, the Tier 1 Manager and DNS (functional and commercial) operation of the central ENUM Tier 1 Registry might also be delegated to (one or more) 'neutral' or non-profit 3rd parties, in view of the national-

²⁰ In fact both "353.e164.arpa" and "3.5.3.e164.arpa" must be delegated. This occurs based on ITU-T authorisation to RIPE, following receipt by ITU-T of consent for this from the Dept.

level importance of those functions. However, this is assumed to be for later decision. If the Tier 1 functions are left open to a commercially-focused market player to operate, then that should clearly only happen under a set of very carefully defined rules. Because recompense for operation of Tier 1 is likely to come from some mandatory levy or charge made by the Tier 1 registry on any Tier 2 players and as there will probably be no competitive forces acting at Tier 1, the choice of Tier 1 players and the rules under which they operate will be crucial to success of the system.

The Tier 2 Nameserver Provider function has potential to be commercially profitable and/or to be a useful ‘bolt-on’ to existing network operator or Directory Enquiry services, but nevertheless if there is only sufficient interest for setting up one such registry in Ireland, the same question marks about monopoly operation arise as for the Tier 1 registry. Indeed in a small country like Ireland there is a real chance of this happening, as it may make technical and/or commercial sense for the Tier 1 registry to be built on the same platform (though with proper partitioning) as a Tier 2 Nameserver – possibly the ONLY Tier 2 Nameserver. In that case the Tier 1 and Tier 2 NS operators are likely to be the same and careful rules to protect customers will be needed.

3.4.4 Should Ireland participate in ENUM at this stage (e.g. trials)? Or at all?

The decision whether to participate in ENUM and the inclusion (or otherwise) of its E.164 national numbering resources in the DNS is a national matter for each country to decide. The convenient course of action is to simply wait to see the results of trials and first commercial moves carried out elsewhere, but that runs a serious risk of relegating Ireland to become a second level player that may miss out on any opportunities that open up²¹. In principle it should be advantageous for Ireland to participate in ENUM as it facilitates and potentially automates communications between IP based services and circuit switched networks; it supports the transition now taking place towards a more general use of IP communications and it also offers a larger choice to the Irish consumer with respect to services. By participating in early/medium stage trials Irish players will be among the first to identify any opportunities (or challenges to existing processes) that arise.

Discussions within ComReg’s Numbering Advisory Panel (NAP) have supported the notion that Ireland should consider carrying out a trial of ENUM, with ComReg playing a central guiding role. The NAP is anxious for ComReg to be pro-active in respect of ENUM and has encouraged ComReg to apply for delegation of the national Tier 1 Registry function.

3.4.5 Which entities should participate in Irish ENUM? How will they interact?

There are very many possible sets of relationships that could be set up in respect of just the Tier’s 1 and 2 of ENUM, even ignoring that a prospective further layer (sometimes called Tier 3) can exist in respect of application service providers (ASPs), who offer the communications services to ENUM users. In addition to entities mentioned already in this document, there is a need for validation entities

²¹ At this stage it is difficult to envisage what innovations or specific opportunities of national importance may spin off from ENUM, but at least it is clear that ENUM is a potentially useful next step in a country’s transition towards the next stage of the information economy.

called Registrars, who confirm the subscriber’s identity and his/her right of use of the relevant number(s). ETSI TS 102 051 [REF 5] describes just four examples with the following characteristics, from this wide range of possibilities:

Example Number	Structure	Comment
Example 1	One Tier 1 Registry + Tier 2 Nameservers + Registrars	This is close to the reference case for ENUM and generally corresponds to the structures shown in this document.
Example 2	Multiple Tier 1 registries+ Tier 2 Nameservers + Registrars	This is a complex model that may be needed in countries where numbering plans need to be sectioned-off for ENUM purposes
Example 3	Combined Tier 1 and Tier 2, with Registrars	Seems well suited to smaller countries with straightforward numbering plans. It can be broadly understood in terms of the structures shown in this document by picturing the Tier 2 Nameserver integrated with the Tier 1 Registry.
Example 4	One multistage Tier 1 registry + Tier 2 Nameservers + Registrars	This is a complex model with each second stage of Tier 1 handling different number blocks

Figure 3: Examples of national ENUM infrastructures

It is proposed that the complexities of Examples 2 and 4 are unnecessary for the Irish situation and indeed that the simplest model of a combined Tier 1 and Tier 2 in Example 3 should be able to handle Irish needs most efficiently. However, if it is decided to merge the Irish ENUM implementation into some other country’s ENUM (e.g. if it transpires that there is only low interest in ENUM in Ireland), then Example 1 is likely to be the most appropriate model.

Note: It is recommended that these examples be fully studied in the original ETSI document, and with the understanding that they are only given there as examples. Nevertheless, they are likely to be treated as good starting points by many European countries.

4 History and Current Status of ENUM

4.1 History

- Beginning (at a formal level) in 2000, The Internet Engineering Task Force (IETF) developed RFC 2916 [REF 1], which introduced the ENUM protocol and RFC 2915 that defines NAPTR records, which are a key feature of ENUM operation. ‘RFC’ is a ‘pre-standard status, but in view of the long development time for standards, can be actually quite advanced. These two RFCs are considered to be relatively stable at this stage.
- After the early-stage development of this work the ITU-T joined with the IETF to focus on the practical administrative requirements for ENUM and provisional agreements are now in place, so that trials may take place. In May 2002 ITU-T agreed interim procedures for the administration of ENUM (e.g. how to handle requests for Tier 1 delegations (such as “3.5.3.e164.arpa”) that allow ENUM trials to proceed.
- At the same time the USA set up an interim ad hoc Advisory Committee, US SGA ENUM Ad-Hoc, under the supervision of the International Telecommunication Advisory Committee – Telecommunications Study Group ‘A’. The aim of this Committee is to provide advice on the participation of the USA in a common ENUM DNS zone and to discuss administration and implementation issues.

4.2 The Current Status of ENUM

- Management of telephone numbering is well established; the ITU defines the International Public Telecommunications Numbering Plan (Recommendation E.164) and is also responsible for the assignment of country codes (e.g. “353” for Ireland, “44” for UK, etc). National numbering plans, which are sub-sets of the International plan and which are the foundation on which ENUM must be built, are controlled by the individual national regulatory authorities for telecommunications; in Ireland this means ComReg.
- The ITU-T has agreed, in conjunction with RIPE NCC, on interim procedures for ENUM’s administration, in order to allow trials to start in interested countries. ITU-T is developing a Recommendation, [REF 15], which offers guidance to national administrations.
- Public Internet (IP) addresses are allocated by RIPE NCC for the European region (see <http://www.ripe.net/ripe/docs/internet-registries.html>). The situation with respect to naming varies between countries but in general individuals and organizations can register under one or more Top Level Generic Domains (gTLD) or under one or more country code TLD (ccTLD). In Ireland registration under the Irish ccTLD takes place through the .ie Domain Registry (IEDR) (see <http://www.iedr.ie>). The operation of ENUM would occur in parallel with this system, under the gTLD “.arpa”.

- The European Commission agrees that ITU-T, RIPE NCC and IAB (Internet Architecture Board) should manage the highest ENUM level, Tier 0 and National Registration Authorities (NRA) for each Member State should manage the next level, Tier 1. It considers that Tier 2 may be maintained by telecoms network operators, service providers or third parties offering services [REF 7].
- Some market players and some administrations are sufficiently interested in ENUM to be carrying out ENUM trials already (see Section 5 below) and more are likely in the future. Recommendations are already in hand by ETSI on how to integrate these and how to guide future ones so that they will be able to inter-operate [REF 12]. The European Commission recognises that such trials are helpful and it supports them [REF 11].
- In the USA, at least three very serious (and to some degree competing) private trials are under way, by Verisign/Telcordia, NetNumber and Neustar. Telcordia and Neustar are major numbering players in the traditional telecoms world, whereas the others are equally important Internet companies. There is a parallel split between those who believe in a free-market unregulated ENUM – possibly with multiple ENUM “Trees” paralleling the .arpa tree – and those who favour a more regulated approach that aligns with the existing well-controlled telephone numbering scheme. The USA has set up an Advisory Committee, US SGA ENUM Ad-Hoc, on the participation of the USA in a common ENUM DNS zone and to discuss administration and implementation issues; this body should help to resolve the issues arising there and provide guidance on the way forward for the USA.

5 Activities elsewhere, including Trials

In **France**, very detailed plans have been developed for study and trial of ENUM, with the preparatory administrative work already completed and the study part commenced in January 2003. Trials are scheduled to start in September of this year with completion in June 2004, followed by 2 months evaluation.

<http://www.itu.int/osg/spu/enum/Implementations/France/france-enum.doc>.

In **Sweden** a Public Consultation was undertaken in August 2001 by the National Post and Telecom Agency. Different views were expressed on Tier 2 role – the incumbent felt the operators should have this role – other organisations did not agree. Most telecoms players wanted to participate in a trial. The National Post and Telecom Agency requested delegation of 6.4.e164.arpa and an ENUM trial was to start in July 2002 and finish in July 2003. (REF <http://www.itu.int/itudoc/itu-t/workshop/enum/009.html>). Progress seems to have stalled as it appears a set of Working Groups completed their pre-trial studies only at the end of 2002, without mention of any trial results.

In **Switzerland** a Public Consultation was undertaken in February 2002 by OFCOM (REF <http://www.ofcom.ch/>).

In the **UK** DTI/Nominimum has secured 44.e164.arpa from the ITU for an Industry Trial. An industry-led work group (UKEG) was set up and participants were invited to join this. The DTI/Nominimum confirmed the list of participants on the 21st October 2002, with the first meeting of that Group being held on 25/11/2002. The actual Trial is planned to run from 1/2003 to 6/2003.) (REF <http://www.itu.int/osg/spu/enum/Implementations/United%20Kingdom/UK-enum.doc>).

In **Austria**, the focus of the national trial is on understanding ENUM technology issues and the potential of ENUM to provide new applications and services. Initial studies commenced in 09/2001 and the trial platform was set up one year later in 09/2002. Interestingly, the trial includes coverage of E.164 numbers issued under the International Country Code (and sub code) 878.10 as well as the Austrian Country Code 43. Elements of the trial under the CC 878.10 were/are being handled by the USA-based organisation VISIONng (a non-profit organisation set up in 2001 and using ETSI TIPHON standards; VISIONng holds the 87810 Tier 1 delegation). Participants include NIC.AT, Telekom Austria, RTR, Infonova, Siemens, Kapsch, Alcatel, ÖFEG. Services running or planned on the system include SIP and H.323 (multimedia), Voice, Fax, Email, Web. The trial may finish its phase 1 in March this year and after an evaluation step will then enter phase 2 until June – following which, commercial operation may start.

The **Netherlands** has set up an ENUM forum “NLEG”, which carried out a preliminary study of ENUM culminating in a report in December 2002. The next

stage will be a detailed consultation, which will lead to decisions on whether to carry out a trial and, if so, in what format.

The **Chinese** ENUM trial is being led by the government, i.e. the Ministry of Information Industry (MII) of China. One main ENUM trial team and five study groups have been established after a first coordinating meeting in March, 2002, covering ENUM Application, Provision, Registration, Regulation and Security, and ENUM International Coordination aspects. It was expected that the actual trial would commence in early 2003 with results due by June, followed by a decision then by the Ministry regarding possible commercial operations.

<http://www.itu.int/osg/spu/enum/Implementations/China/china-enum.doc>

In the **USA** an Open Industry Forum has been established, (<http://www.ENUM-Forum.org>). They are considering whether to go for a single or multiple Tier 1 structure (REF <http://www.itu.int/itudoc/itu-t/workshop/enum/013.html>).

Note: the USA supports the interim procedures agreed by ITU-TSB SG2 for the administration of ENUM.

On February 12, 2003, in a letter from Assistant Secretary of Commerce Nancy J. Victory to Ambassador David A. Gross, U.S. Coordinator for International Communications and Information Policy, the National Telecoms Agency NTIA recommended “that the U.S. take initial steps toward opting in to e164.arpa, the new global Internet domain set aside for the matching of Internet addresses and telephone numbers, taking note that 19 nations have now taken steps in that area”. This was followed up by the FCC on February 13, in a letter from its Chairman Michael Powell, who endorsed the Dept. of Commerce’s recommendations and looked forward to working with the other agencies “on this important issue”.

Korea is studying ENUM and has developed plans for its introduction.

<http://www.enum.or.kr/en/bbs2/view.html?Table=news&SN=5>.

6 Proposed Irish Approach to ENUM

It is important that Irish enterprises and service providers should have the maximum opportunity to participate and produce innovative solutions, in line with the Government's policy of moving this country to a leading position in the information and communications revolution. This means that the opportunity to participate in ENUM trials and/or to actively monitor ENUM developments should be available to all. Accordingly, ComReg is taking the initiative in opening this public consultation and seeking views that may guide further developments. The questions posed in this consultation are designed to elicit the levels of interest that exist and to determine the direction and extent to which respondents are prepared to move in support of an ENUM trial and/or full introduction of ENUM (once the international and European groundwork is set).

In order to move forward, it is proposed that the next steps should build on existing Irish positions, relationships and strengths, without prejudice to any long-term arrangements that might be set up for ENUM and subject to any decisions made as a result of the present consultation. Accordingly, the following structure and initiatives are suggested:

1. The Department of Communications, Marine & Natural Resources is responsible for the regulation and use of the "ie" domain name²². The Department also provides the recognised official contact point for Ireland in respect of ITU-T and its approval is necessary before ITU-T will authorise RIPE NCC to delegate the 353 Tier 1 Registry to an Irish person. Practical moves forward on ENUM are therefore dependent on the Department's decision to either carry out the Tier 1 function itself or to agree to its delegation to ComReg or to some other entity.
2. ComReg, being in control of the E.164 National Numbering Scheme - which is at the core of ENUM - is well-placed to operate the 353 Tier 1 Registry for trial purposes but alternatively a special entity could be set up specifically for this purpose. The selected body will become the Tier 1 Manager. Delegation of "3.5.3" Tier 1 to the Tier 1 Manager could be done directly from ITU-T to the Manager, with Departmental consent, or else a first delegation could be made to the Department itself followed by a subsequent delegation (with notification of this to ITU-T) from the Department to that body. In any case, ComReg would thereafter need to assure itself that ENUM development under the Irish Tier 1 is compatible with management of the national numbering resource itself.
3. For trial purposes, the Tier 1 Manager should delegate **operation** of the Tier 1 registry function to some suitable entity, based on selection from among any expressions of interest received. The Manager should also prepare a set of rules which will ensure public confidence in the fair, transparent and non-discriminatory operation of the Tier 1 registry function – which will in effect have monopoly status. For later commercial ENUM operation, a public

²² Under Section 13 of the Communications Regulation Act, 2002 and Section 31 of the Electronic Commerce Act, 2000, respectively.

tender is likely to be needed to seek a long-term provider of the Tier 1 registry function (which might be open to combination with a Tier 2 Nameserver function, under suitable rules).

4. The Tier 1 Manager should open provision of the Tier 2 Nameserver Provider function to competing service providers, to the extent that interest is shown in this²³. This may be carried out during a potential trial stage by public tender or simply by inviting expressions of interest and determining on the result. The Manager should also prepare a set of rules which will ensure public confidence in the fair, transparent and non-discriminatory operation of the Tier 2 Nameserver function by its providers.
5. The Tier 1 Manager should open provision of the Tier 2 end-user registration and authentication service to competing ENUM Registrars, to the extent that interest is shown in this. This may be carried out during a potential trial stage by public tender or simply by inviting expressions of interest and determining on the result. These Registrars would register their customers with the Tier 2 Nameserver Provider(s) of their choice (and also insert corresponding entries in the Tier 1 Registry), based on normal commercial and competitive arrangements. The Manager should develop a simple code of practice for the Registrars that will ensure public confidence in ENUM and in verification of the authenticity of information being submitted for registration.
6. ComReg should determine, based on the results of this consultation, **whether** an Irish ENUM trial should be carried out and - if so – what the parameters and extent of that trial should be. It should then, if the answers support this, use its best endeavours to facilitate such a trial, which should also be integrated with other European trials in accordance with ETSI guidelines.
7. A trial, if carried out, should be limited in extent to a matter of 3-6 months and with its objectives clearly defined beforehand. A short report of the trial results should subsequently be published on ComReg's web site for the benefit of others who might be interested in exploring ENUM opportunities.
8. A trial may involve a reduced number of concerns compared with full commercial ENUM operation but nevertheless real end-users must be involved, with real concerns about the usage, accuracy and widespread opening of access to certain of their personal data. There are other issues that can arise such as the handling within ENUM processes of ported telephone numbers, amendment/deletion of existing registry data, churn between Tier 2 Nameserver Providers etc. A forum will need to be set up to agree on how to handle these matters for trial purposes, though this might possibly be limited to one or at most two meetings.

²³ The Tier 1 registry provider is not excluded from also providing a Tier 2 Nameserver service (in competition with other Tier 2 services) but in that case it must demonstrate clear separation between the two and follow rules ensuring non-discrimination.

7 Consultation Questions

With the background to and issues surrounding ENUM explained in detail in earlier chapters and with deeper explanations included in the Appendixes, this chapter concentrates on the consultation questions that arise and to which answers are now sought. Responses are invited from any quarter with an interest in ENUM, whether Public body, telecoms organisation, Internet-based body or user entity but they are especially welcomed, without commitment, from any party that may be considering offering ENUM services of any kind. It would be helpful for such persons to identify their proposed level and type of involvement in the proposed trial as this will help ComReg to ensure they are kept informed of any initiatives that may occur.

7.1 Questions on General Issues Surrounding ENUM

7.1.1 Data Confidentiality & hijacking

Section 3.3.2 discusses data confidentiality and certain abuses that can occur in respect of ENUM, even when the opt-in principle is followed. It is difficult to totally prevent such abuses but if they aren't tackled then the growth of ENUM will be inhibited.

Section 2.3.2 addresses hijacking, which is a more serious type of ENUM abuse, though it is easier to see ways of tackling this with careful controls by the Registrar (who authenticates ENUM applicants) as well as proper network regulation of service providers/operators. Nevertheless comments and suggestions for preventing or tackling these abuses are welcomed.

Q. 1. Have you suggestions for avoiding or minimising the above abuses in Irish ENUM implementations, while placing the least barriers in the way of the emergence of ENUM?

7.1.2 Demand for E.164 Telephone Numbers

Section 3.3.4 makes it clear that ENUM, of itself, should bring no additional need for numbers but indirect consequences of ENUM and/or other IP services could conspire to “spring” a sudden unexpected demand. In addition, suggestions have been made in some fora for setting aside dedicated “ENUM ranges” (to improve look-up efficiency etc). ComReg is unaware of any imminent danger from this direction but if a real risk arises then our shortage of completely empty number ranges, coupled with the long provisioning timescale for number recovery, could present difficulties. In the past, consideration was given to setting aside a special range of numbers for IP-related applications and it could be appropriate to activate such a plan at this stage - for IP and ENUM - if signs of demand for such services start to appear.

Q. 2. Do you agree that there is no imminent threat of undue demand for numbers arising from ENUM (or other IP services)? If you disagree, please explain and – if possible – try to indicate the scale of the demand.

7.1.3 Parallel ENUMs and Usage of E.164 Numbers

It is proposed in this document (Section 3.3.7 above) that public ENUM in Ireland should be based on the architectural structure of a single ENUM tree, in line with the preferred external trend towards a single international ‘golden tree’ (i.e. whether or not parallel trees do appear in certain jurisdictions). Furthermore, it is proposed that each Irish E.164 telephone number should only be permitted to be populated into a single public “3.5.3” Tier 2 Register database to avoid ambiguous situations. If they are populated into private ENUM databases – whether in Ireland or abroad then those databases should not be accessible by any public DNS query.

Note: A “3.5.3” public ENUM service could not be provided elsewhere without Irish approval, though it might be possible for “3.5.3-like” services to be offered from anywhere (e.g. “<Tel No>.353.e164.arp”); consequently any ENUM rules should also seek to restrict number-holders from simultaneous participation in these and in the authentic “3.5.3” ENUM tree.

Q. 3. Do you agree that Ireland’s participation in public ENUM should avoid undue complexity by following the single tree approach at national level (i.e. only one “3.5.3” Tier 1 Registry branching to one or more Tier 2 Nameservers)²⁴?

If you disagree, please explain your concerns and/or suggest alternatives.

7.1.4 E.164 Number Types Permitted to Register

ENUM can be used with E.164 telephone numbers of all kinds but the use of non-geographic numbers and short codes²⁵ for this purpose needs special consideration. It is proposed that a ‘cautiously liberal’ approach should be adopted pending greater experience of ENUM, with each request for registration of non-geographic number or short code initially being referred to ComReg for decision. ComReg should assume, until experience suggests otherwise, that Personal Numbers and Universal Access numbers are suitable for registration, while Freephone, Shared-Cost numbers, and Premium Rate numbers²⁶ are unsuitable due to potential clashes with Dublin geographic number ranges. It should also be assumed that short codes which provide access to certain public services compatible with email contact (e.g. 118XX DQ services) may also be suitable for ENUM, while others (e.g. Network Use codes) are not; short codes must therefore be decided on a case-by-case basis.

²⁴ Note: This would mean that each Irish E.164 number could only be populated into a single Tier 1 Registry and a single Tier 2 Nameserver that are publicly accessible though there is no reason why it couldn’t also be populated into a totally private ENUM database. In consequence, no ENUM query of the number should be able to return more than one set of NAPTR records.

²⁵ This implies that ordinary geographic telephone numbers and ordinary mobile numbers are considered to be automatically suitable for registration.

²⁶ There may be additional reasons for excluding Premium Rate Numbers.

Q. 4. Do you agree that geographic and mobile E.164 numbers, as well as Personal and universal Access numbers should be considered suitable for registration in ENUM from the outset, subject to ongoing experience and monitoring by ComReg? Furthermore, do you agree that other types of non-geographic numbers should be considered unsuitable (at least initially), while short codes should be considered suitable only after individual consideration (per code type) by ComReg?

7.1.5 To Participate Now, or Not?

Section 3.4.4 above discusses Irish participation in ENUM and indicates that there is already some support and pressure for a national initiative to be undertaken, possibly including a national ENUM trial and/or integration into a wider European trial (subject to agreement by other European partners). Practical moves would in any case be dependent on the Department's decision to either carry out the Tier 1 function itself or to agree to its delegation to ComReg (or some other entity).

The most minimal degree of participation would be to not carry out a trial and simply agree with some other country that its own ENUM registries and market players could also be encouraged to provide similar services for Irish E.164 number-holders; in contrast, "fully" participating in ENUM (as in the next question) is assumed to mean Irish-based and Irish-controlled ENUM services. A 'half-way house' would be to formally contract with another country to host Irish ENUM services, under full Irish control, on that country's servers.

Q. 5. Do you consider that Ireland should participate fully in ENUM, in principle and/or²⁷ do you believe that Ireland should undertake its own ENUM trial to build experience in ENUM and to better understand the technologies, opportunities and challenges?

²⁷ This is an "and/or" situation as Ireland could decide to participate in ENUM without a trial by seeking to learn second-hand from experience elsewhere or could carry out a trial and then decide to opt out if the results are unsatisfactory.

Q. 6. If you do not consider that Ireland needs to participate fully or carry out a trial at this stage, do you believe that arrangements should be made – at an appropriate stage - with another ENUM country to offer ENUM services to Ireland either:

(a) under full Irish management and control; or

(b) with formal Irish involvement limited to agreeing that Irish E.164 numbers can be inserted into and served from that country’s ENUM system?

Please comment.

7.2 Questions Specific to a Trial

7.2.1 Monopolies and the Players within an Irish ENUM System

As explained in section 3.3.5, the Tier 1 Registry function is a natural monopoly, overseen (along with the whole national operation of ENUM) by the Tier 1 Management function; well thought-out management rules are therefore important. ComReg proposes that it should itself undertake this Manager role, thereby allowing it to set down appropriate rules for the Tier 1 Registry, as well as for the Tier 2 Nameservers and Registrars; this is in line with expectations at ITU and ETSI level as Figure 6 and Figure 7 (in Appendix 1) show.

There is a strong argument for keeping Ireland’s implementation of ENUM – at a minimum in respect of any potential trial – as simple as possible, by permitting the Tier 1 Registry operator to also offer Tier 2 Nameserver services. This might, however, be considered to increase the risk element inherent in the monopoly nature of the Tier 1 Registry, even after appropriate safeguards are specified.

Finally, for a small country, unless there is sufficient competition for the separate functions, there are arguments for permitting Tier 2 Nameserver Providers (apart from one that might also be offering the Tier 1 Registry service) to also offer Registrar functions (i.e. ‘recruit’ ENUM customers and register them on their own Tier 2 Nameserver databases).

Q. 7. Do you agree with the proposal in Chapter 6 that ComReg, as the manager of the E.164 National Numbering Scheme and National Regulatory Authority, should seek delegation to itself of the “353” Tier 1 Registry Manager function for trial purposes, subject to any decisions on ENUM made by the Department²⁸? If you disagree, do you wish to propose a suitable other entity or that a special body be set up (please discuss)?

²⁸ This question and others in this document would not apply or would apply in altered format should the Department itself decide to lead any Irish trial.

Q. 8. Do you agree that the Tier 1 Manager should then in turn delegate technical operation of the Tier 1 Registry to some suitable entity, based on expressions of interest and/or tender, as appropriate, while maintaining the Tier 1 Manager role? The Manager would set down the rules of operation for the Registry to obviate concerns about potential monopoly abuse.
If not, please describe your alternative proposal.

Q. 9. Do you agree with the concept of permitting the Tier 1 Registry Provider to also carry out the Tier 2 Nameserver Provider function (in competition with others and operating under appropriate rules)
(a) regardless of other considerations?
(b) if suitable persons are not otherwise found to carry out these functions independently.
If you disagree, please comment.

7.2.2 Architecture of an Irish ENUM Trial

A key decision for ENUM operation is the model adopted from the very wide range of available possibilities, just four of which are summarised in Figure 3, above. It may not be technically very difficult to change to a different model after the trial if the chosen model is found to have limitations but legal difficulties and market resistance to a change would probably arise in respect of any subsequent change. Section 3.4.5 above discusses this matter, and proposes that Ireland initially selects either Example 1 or Example 3 from ETSI document TS 102 051 as its foundation. It further suggests that, if Ireland is to set up its own ENUM infrastructure, then the model of Example 3 is adequate and would be most efficient, whereas if we allow “353” ENUM services to be provided by some larger country (i.e. whether run under Irish national control or under the control of that country, with Irish permission) then it is most likely that the Example 1 model would be followed.

Answers to the next question are therefore likely to be dependent on how the last question above was answered.

Q. 10. If you believe that Ireland should set up its own independent “353” ENUM system do you agree that at least for trial purposes the simplest model, broadly as described in ETSI Example 3 should in principle²⁹ be the basis?

Note: A trial might well include other compromises if these were justified on cost, speed or practicability grounds (e.g. merged trial with some other country).

7.2.3 Irish ENUM Entities for Trial Purposes

It is proposed in Chapter 6 above that the Tier 1 Registry operator and Tier 2 Nameserver operators (whether combined or not) should be selected by competitive tender.

It is also proposed in Chapter 6 that the Registrar function should be open to all interested parties³⁰.

Q. 11. Do you agree that for trial purposes, the Tier 2 Nameserver operators function (whether combined with Tier 1 or not) should be selected by competitive tender, if there is more than one expression of interest in this?

Q. 12. Do you agree that for Trial purposes, the Registrar function should be open to all interested parties (subject to certain restrictions based on background and capabilities)?

7.2.4 Measuring Interest in an ENUM Trial

Chapter 5, bullets 6, 7 and 8 specifically address the issue of an Irish trial of ENUM and other sections of this document also address it. Trials are being carried out elsewhere and it is possible to learn a great deal from these, though inevitably only real experience can fully prepare the various ENUM players for their role and identify clearly for them what the real difficulties and opportunities are. Interest has been expressed in the holding of such a trial and ComReg has determined to pursue this and assist if possible, although ComReg also considers any such trial should primarily be industry-driven. The following questions are intended to elicit how

²⁹ Subject to change, of course, if emerging ENUM developments make this advantageous.

³⁰ In fact, certain qualifications on background and capabilities would be needed to avoid risk of abuse of confidential information.

serious is the interest in performance of an actual Irish trial and how – in broad terms – it should be carried out.

Q. 13. How important does your organisation consider ENUM to be and to what degree do you consider it to be a business opportunity (for you or for Ireland in general)?

Q. 14. Do you consider that an Irish ENUM trial should be carried out and if so do you agree that it should, as far as can be arranged, be integrated into any overall European ENUM trial infrastructure³¹? Please comment.

Q. 15. If you believe that an Irish ENUM trial should be carried out would you accept that the possibility of using spare infrastructure – if any – available in other triallist countries, rather than acquiring/developing new Irish infrastructure, should be explored? Please comment.

Q. 16. To what extent might your organisation be interested in participating in a trial, and in which role(s)?

Q. 17. Are you able to provide real end-users and/or real applications/services³² to test the operation of ENUM in the trial and provide useful feedback? Please comment.

Q. 18. Do you wish to suggest any parameters for the trial and/or to list issues that it should address and how?

³¹ This means integration on a peer-to-peer basis with Irish ENUM being an independent subset, as distinct from Irish ENUM being subsumed into another country's ENUM trial.

³² For example SIP, H.323, Other VoIP, email, fax, SMS, Web, IM, Global services

Q. 19. Are you prepared to participate in or initiate a working group or forum to guide development of an Irish ENUM trial and perhaps later introduction of commercial ENUM? Have you any comments/suggestions for such a WG or forum?

Q. 20. Are you prepared to lead an industry initiative to carry out an ENUM trial and/or to move towards full commercial ENUM implementation in Ireland?

8 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 26, March 2003 to 2, May 2003 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 publish a report in July on the consultation which will, *inter alia* summarise the responses to the consultation.

In order to promote further openness and transparency ComReg will publish the names of all respondents and make available for inspection responses to the consultation at its Offices.

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. Respondents are requested to clearly identify such confidential material and if possible to include it in a separate annex to the response. Such information will be treated as strictly confidential.

Appendix 1: Relationships within ENUM

ENUM, structured under the “.arpa” Top Level Domain (TLD), is part of the whole Internet Domain system, as can be seen from Figure 4, below (Note: Figure 2 gives an alternative view of just the “.arpa” branch of this tree).

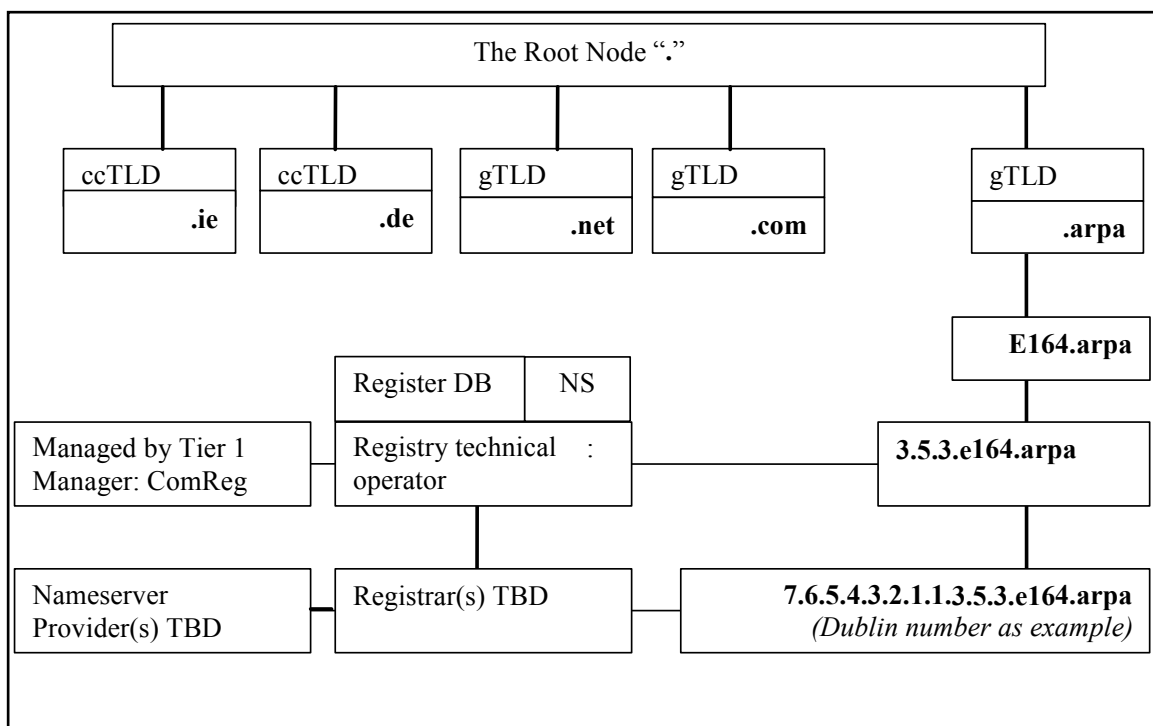


Figure 4:ENUM is Part of the Whole Domain Name System (DNS)

The 353 Tier 1 central registry may have only limited commercial appeal but below this be one or more (commercially attractive) Tier 2 Nameserver services. In Ireland it is possible that a combined Tier1 registry with Tier 1+Tier 2 Nameserver could suffice (alongside competing Tier 2 Nameserver services) and be the most efficient approach, whereas in larger countries these Tier 1 & Tier 2 Registries would be separate. The possibility of Registrar functions also being offered by the same entity as a Tier 2 Nameserver Provider could also exist but a combined Tier 1 Registry + Tier 2 Nameserver + Registrar should be considered too monopolistic.

Note: A 'Registry' is defined as an entity that runs a DNS authoritative server for some specific domain, while a 'Registrar' is an entity that provides direct services to domain name registrants by processing name registrations. For practical purposes, it seems to make sense for some or all of the Tier 2 Registrars, who make entries in the Tier 2 Nameservers, to also be authorised to carry out the corresponding Tier 1 Registrar function i.e. simultaneously make the corresponding entries in the Tier 1 Register database.

The next figure shows the core ENUM relationships, from the international level through to the end-user, apart from the Registrar, who assembles and enters the customer data in the relevant databases.

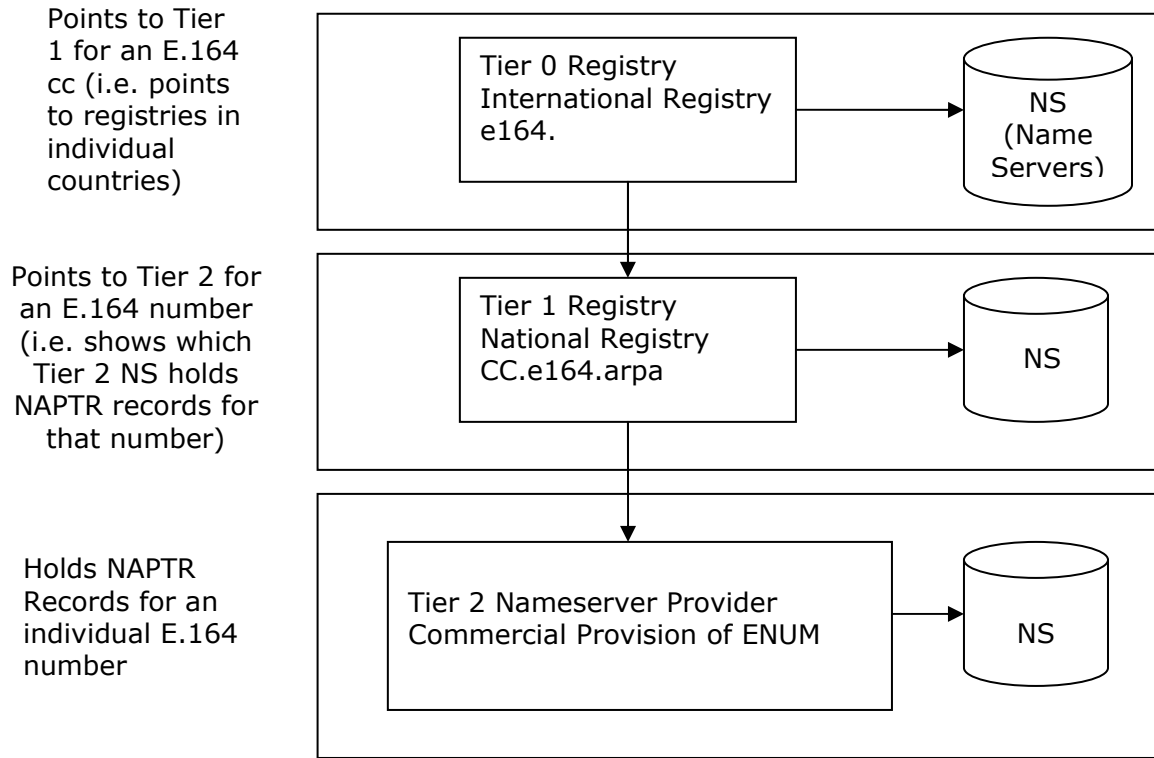


Figure 5: The ENUM Reference Model

The following table (Figure 6), from ETSI Technical Specification TS 102 051 [20], shows the various entities at each ENUM domain level, with their assigned functions and responsibilities.

ENUM: Accessing Multiple Customer Services Through Telephone Numbers

Domain	Designated manager ³³	Responsible technical organization for the domain (<i>Registry</i>)	Registrar	Delegations from zone made to
“.” (DNS Root level)	DNS Root Manager ICANN through agreement (see note 1) with U.S. DoC	DNS Root Registry IANA, which is part of ICANN	DNS Root Registrar N/A	N/A
.arpa (TLD level)	TLD Manager Entity responsible for managing the TLD level.	TLD Registry Entity designated by the TLD Manager	TLD Registrar	
.e164.arpa (ENUM Root level)	ENUM Tier 0 Manager Entity responsible for managing the ENUM Root level.	ENUM Tier 0 Registry Entity designated by the ENUM Tier 0 Manager.	ENUM Tier 0 Registrar ITU TSB	The Registrant: i.e. the ITU Member state or the NRA.
<CC>.e164.arpa (ENUM CC level)	ENUM Tier 1 Manager The ITU Member state (see note 2) who has been assigned the CC. The member state can delegate this responsibility to the NRA or other appropriate entity.	ENUM Tier 1 Registry The ITU Member state or the NRA can manage this in their own activities or designate someone else to act as the ENUM Tier 1 registry.	ENUM Registrar	
<N(S)N>.<CC>.e164.arpa (ENUM E.164 number level)	ENUM Tier 2 Manager ENUM end user – i.e. <i>national matter</i>	ENUM Tier 2 Nameserver Provider	ENUM Registrars – e.g. a Telecoms SP or other ENUM SP – (<i>a national matter</i>)	The registrant will be the ENUM end user (or possibly his agent)
NOTE: According to section III B (i-v) in MoU between U.S. DoC and ICANN (http://www.icann.org/general/icann-mou-25nov98.htm) and according to section 1 in agreement between USC and ICANN (http://www.icann.org/general/usc-icann-transition-agreement.htm).				

Proposed Arrangements for Ireland				
<i>Note: The next two rows correspond to a specific implementation of the last two rows above.</i>				
3.5.3.e164.arpa	ENUM Tier 1 Manager: (ComReg or the Dept. suggested) (by delegation from the Dept. of Communications, Marine & Natural Resources)	ENUM Tier 1 Registry: Selected from Expressions of Interest (by delegation from Tier 1 Manager)	ENUM Registrar Open: TBD if same entities as for Tier 2 (see below) or more restricted	
7.6.5.4.3.2.1.1.3.5.3.e164.arpa (ENUM E.164 number level)	ENUM end user	ENUM Tier 2 Nameserver Provider	ENUM Registrars – (Open: suggest this could be Telecoms telcos/SPs &/or Internet ISPs/IEDR)	The registrant will be the ENUM end user (or his agent, if any)

Figure 6: Responsibilities assigned to different functional entities for ENUM Domains in the DNS (per ETSI TS 102 051).

The next set of tables, prepared by Neustar³⁴, provide an alternative (but complementary) description of the relationships and roles of the various ENUM functions and the entities providing those functions. The first table (Figure 7) illustrates some basic attributes of the DNS Tiers for E.164 numbering in ENUM, and is based on an example taken from RFC 3026, using French telephone numbers (i.e. +33...).

³³ In accordance with IETF RFC 1591: Domain Name System, Structure and Delegation.

³⁴ Ref: http://www.ngi.org/enum/ENUM_AdHoc/meeting2/NeuStar_SGA%20AdHoc%20Contribution.htm

Domain	[ENUM.Root]	3.3.[ENUM.Root]	1.5.1.5.0.2.0.4.1.3.3.[ENUM.Root]
Type of Tier	“Tier 0”	Tier 1	Tier 2
Authority for the Domain	The ITU.	The NRA(s) (from the ITU perspective): <ul style="list-style-type: none"> •• via DNS delegation from the ITU, and •• consistent with the E.164 country code assignment. 	A national matter: <ul style="list-style-type: none"> •• via DNS delegation of authority from the country’s Administration, •• consistent with the E.164 number assignment, and •• based on the assignee of the number subscribing to ENUM.
Administrator/ Operator of the Domain	As designated by the ITU.	As designated by the NRA.	A national matter: as designated by the entity with delegated DNS authority.
DNS Record(s) within the Domain	A record points to the sub-domain 3.3 of [ENUM.Root].	A record points to the sub-domain 1.5.1.5.0.2.0.4.1 of 3.3.[ENUM.Root].	Records contain URIs with address information for (IP-based) specific services: <ul style="list-style-type: none"> •• the assignee of the number subscribes to each specific (IP-based) service, •• the assignee of the number chooses to have each service-specific URI be in DNS for ENUM, and •• the URIs are associated with the assigned number.

Figure 7: DNS Tiers for E.164 Numbering in ENUM

The next three tables below describe the roles of functional entities involved in ENUM services, and contain additional information on relationships between these entities. Table 2 looks at the four levels of ENUM Tiers, while the Users and Service Providers are described in Tables 3 and 4 respectively. These groupings help clarify how the different roles need to interact in order to provide ENUM services.

Functional Entity	ENUM/DNS Role	Information	Comments
[E.164/ENUM DNS Root]/ “Tier 0” Entity	<ul style="list-style-type: none"> Operates the DNS ENUM Root. 	<ul style="list-style-type: none"> Holds ENUM information about E.164 country codes. 	<ul style="list-style-type: none"> NS records point to Name Servers for the DNS Registry for each E.164 country code in ENUM.
Tier 1 Entity	<ul style="list-style-type: none"> The DNS Registry for a country code level ENUM domain. 	<ul style="list-style-type: none"> Holds ENUM information about E.164 numbers. 	<ul style="list-style-type: none"> NS records point to Name Servers for the DNS Registrars within the E.164 country code in ENUM.
Tier 2 Entity	<ul style="list-style-type: none"> A DNS Registrar of E.164 numbers for ENUM within a country code. 	<ul style="list-style-type: none"> Holds ENUM information about service-specific addressing that is associated with an E.164 number. 	<ul style="list-style-type: none"> NAPTR records hold service-specific address information for the Registrants of E.164 numbers for ENUM with the DNS Registrar.
Tier 3 Entity (may or may not exist for a specific (IP-based) service)	<ul style="list-style-type: none"> Contains service-specific information for client software (i.e. for the benefit of the caller) to use after performing its ENUM query. 	<ul style="list-style-type: none"> Depends on the specific service. 	<ul style="list-style-type: none"> Depends on the specific service.

Figure 8: Functional Entities within ENUM DNS Tiers

Functional Entity	ENUM/DNS Role	Information	Comments
<p>ENUM End User/ ENUM Subscriber/ Called User</p>	<ul style="list-style-type: none"> •• The DNS Registrant of an assigned E.164 number for ENUM. •• Is a subscriber to at least one (IP-based) specific service. •• Is the authority for using ENUM to associate information for that specific service with the E.164 number. 	<ul style="list-style-type: none"> •• Provides information on an E.164 number assignment and on specific services. •• Specifies preferences for the association of specific services with the E.164 number. •• Intends that calling users could contact the End User by using ENUM information. 	<p>An End User has three types of subscription:</p> <ul style="list-style-type: none"> •• as assignee of an E.164 number [for a telephony service]. •• as subscriber to one or more (IP-based) specific services. •• as party responsible for specifying how ENUM associates the number with service-specific URIs.
<p>Calling User/ Caller/ Originator</p>	<ul style="list-style-type: none"> •• Is a calling user who queries DNS to retrieve service-specific information associated with the E.164 number of an ENUM End User. •• May or may not use the service-specific addressing information to “call” the ENUM End User. 	<ul style="list-style-type: none"> •• Intends to contact an ENUM End User via a specific service but addressed with an E.164 number. •• Uses ENUM-enabled client software to discover End User’s chosen services. •• May or may not choose a specific service to contact the End User. 	<ul style="list-style-type: none"> •• A calling user chooses to contact an ENUM End User. •• ENUM-enabled software performs the ENUM query. •• Service-specific software makes the “call” using service-specific address information resulting from an ENUM query of a number.

Figure 9: Functional Entities - End Users and Calling Users for ENUM

Functional Entity	ENUM/DNS Role	Information	Comments
Telephony Service Provider (TSP)	<ul style="list-style-type: none"> •• The provider of telephony service to an End User (Subscriber) of that service. 	<ul style="list-style-type: none"> •• Is authorized by the End User to provide current information about the assigned E.164 number to the Service Registry. 	<ul style="list-style-type: none"> •• The E.164 number is assigned to an End User for the subscribed telephony service.
Applications Service Provider (ASP)	<ul style="list-style-type: none"> •• The provider of a specific IP-based service to an End User (Subscriber) of that service. 	<ul style="list-style-type: none"> •• May be authorized by the End User to provide current information about the service-specific URI to the Service Registrar. 	<ul style="list-style-type: none"> •• The ASP may be authorized by the End User to add, change, or delete the service-specific NAPTR held by the Service Registrar.

Figure 10: Functional Entities - ENUM Service Providers

Appendix 2: Basic Principles to follow in an ENUM implementation

The following basic principles that should be considered as key requirements when ENUM planning is undertaken, are extracted from ETSI TS 102 051:

- The ENUM end user must be the assignee of an E.164 number to ensure the integrity of the E.164 numbering plan;
- The integrity of the ENUM data shall not be compromised;
- Administration requirements must take due account of the different number types and methods of management of the E.164 Numbering Plan;
- The tenets of relevant ITU-T Recommendations, and IETF technical specifications should be adhered to;
- A competitive environment within Europe and compliance with all aspects of competition law shall be facilitated;
- A stable and secure environment which does not jeopardize the stability and functionality of the Internet and telecommunication networks (e.g. PSTN, ISDN and PLMN) shall be provided. The use of DNSSEC to provide additional security should be considered;
- There must be full conformity with regional and national data protection and privacy laws for all data within ENUM;
- Handling of numbers in ENUM shall occur in a manner that is in full accordance with relevant national regulatory requirements;
- Existing network functions such as Number Portability which are often provided as national implementations, must not be compromised;
- The Opt-in principle shall apply for end users to participate in ENUM (ETSI TS 102 051 clause 7.2 expands on this);
- If the preferred assignment entities choose not to participate then the progress of ENUM should not be impeded; alternatives should be quickly found.

Appendix 3: References

1. P.Falstrom, IETF RFC 2916, E.164 number and DNS (September 2000).
2. ODTR 02/45: "Potential Applications for Next Generation Networks – Briefing Note".
3. ComReg 03/21: "Voice Over Internet Protocol".
4. Comments and proposal on draft ETSI TS "ENUM Administration in Europe" V0.1.5, Feb 2002-04-1.
5. ETSI Technical Specification TS 102 051 V1.1.1 (2002-07): "ENUM Administration in Europe".
6. Global Implementation of ENUM: A Tutorial Paper.
7. ONPCOM02-15 (Proposed EU position on ENUM implementation).
8. ONPCOM01-12 (Regulatory issues of Naming, Addressing and Numbering).
9. ONPCON01-24 (Regulatory issues of Numbering, Naming and Addressing).
10. WS ENUM-5-E – Version 7 of the ENUM Supplement by SG2.
11. ONPCOM02-04 (Open Network Provision Committee).
12. Draft ETSI TS 2XX XXX V<0.0.7> (2003-01): "Minimum Requirements for Interoperability of European ENUM Trials"
13. The Status of UK Implementation – ITU February 2002 by Tony Holmes.
14. E.A-ENUM: "Principles and procedures for the administration of E.164 geographic country codes for registration into the domain name system".
15. TD WP1-42 Rev.1: "Final Interim Procedures as agreed by ITU-TSB SG".

Appendix 4: Definitions & Abbreviations

Definitions

E.164 No	A telephone number that uses a string of decimal digits to uniquely indicate a public network termination point. The Number contains the information necessary to route calls to this termination point. In practical terms the number is likely to correspond to an identifier for a fixed or mobile handset or a DDI number.
.arpa	The Address and Routing Parameters Area top level domain, used for network infra structure.
Domain	A set of host names consisting of a single domain name and all the domains below it.
Registrar	An Entity that provides direct services to domain name registrants by processing name registrations.
Registry	An Entity that runs the DNS authoritative server for some specific domain.
E164.arpa	In the “.arpa” domain, the sub-domain of ENUM names in which E.164 telephone numbers reside.
Tier 0 Entity	Entity that maintains the name server for the e164.arpa zone containing the authoritative NS records for domain names corresponding to recommended E.164 Country Codes or portions thereof, as defined by ITU member states.
Tier 1 Entity	The entity that operates the Tier-1 ENUM service within a country or Region and has (a) pointer(s) to the Tier 2 Entity or Entities for all ENUM-enabled telephone numbers in that country.
Tier 2 Entity	The entity that hosts the NAPTR resource records associated with each telephone number.

Abbreviations

CC	Country Code (as specified in the ITU-T Recommendation E.164)
Department	Department of Communications, Marine and Natural Resources
DNS	Domain Name System
ENUM	Telephone Number Mapping
IAB	Internet Architecture Board
IANA	Internet Assigned Numbers Authority
IETF	Internet Engineering Task Force
IP	Internet Protocol
ITU-T	International Telecommunications Union – Telecommunications Standard Sector
ISDN	Integrated Services Digital Network
NAPTR	Naming Authority Pointer Resource Records. A DNS resource record that specifies a regular expression-based rewrite rule, which when applied to an existing string, will produce a new domain label or a Uniform Resource Identifier (URI)
NPA	Number Plan Administrator
NRA	National Regulatory Authority
PSTN	Public Switched Telephone Network
PLMN	Public Land Mobile Network
RFC	“Request For Comments” – A pre-Standard stage document, where public comments are invited
RIPE NCC	Reseaux IP Europeens Network Coordination Centre
RR	DNS Resource Records
SG2	ITU-T Study Group 2
TLD	Top Level Domain
URI	Uniform Resource Identifier – A URL is one type of URI; an email address is another
URL	Uniform Resource Locator