TR 101 056 V1.1.1 (1997-06)

Technical Report

Human Factors (HF); European Numbering Task Force (ENTF); Human Factors aspects of the European Telephony Numbering Space (ETNS)

Reference
DTR/HF-01039 (9s000ics.PDF)

Keywords
Addressing, CLIP, HF, migration, portability,
service, UNI, UR, user

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Human Factors (HF).

Introduction

Background

European Telecommunications Office (ETO) will, on behalf of European Committee on Telecommunication Regulatory Affairs (ECTRA) for the Commission of the European Communities (CEC), produce proposals for the whole management of the European Telephony Numbering Space (ETNS). ETSI, under a separate mandate from the CEC, has been requested to produce a comprehensive proposal for the Human Factors aspects of the ETNS.

This Technical Report (TR) presents the results of the ETSI's studies on the topic. The intention is to develop the material from this TR into an ES by the end of 1997 in accordance with the European Numbering Task Force (ENTF) work plan.

1 Scope

The present document focuses on the Human Factors (HF) aspects of an ETNS. It covers those aspects of pan-European services that would be of importance to the users of those services and to other telephony users who may be impacted by the introduction of an ETNS. Such aspects include:

- difficulties with long numbers;
- effects due to number portability;
- how users identify a European service and its charging;
- the effect of call delays;
- the linguistic difficulties associated with European services;
- the need for usability testing.

Mobility aspects of an ETNS are outside the scope of this TR.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] DTR/NA-021408: "Technical management aspects of a European Telephony Numbering Space (ETNS)".

[2] ITU-T Recommendation E.164: "Numbering plan for the ISDN era".

[3] Miller, G.A.: "The magical number seven, plus or minus two: some limits on our capacity for processing information". The Psychological Review, Vol 63, p.2. March 1956.

[4] Magnussen, S.; Dyrnes, S.; Korsnes, M.S.; Nordby, K.: "Scientific Report, Telenor FoY R11/96: Dialling Domistic: Short-term memory for graphically grouped eight-digit number".

[5] "Towards a European Numbering Environment: Green Paper on a Numbering Policy for Telecommunications Services in Europe". Commission of the European Communities, COM(96) 590.

[6] ITU-T Recommendation E.123: "Notification for national and international telephone numbers".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CC	Country Code
CEC	Commission of the European Communities
CLI	Calling Line Identity
CLIP	Calling Line Identification Presentation
CN	Corporate Number
CN_ID	Corporate Network IDentity
CSSC	Country Specific Service Code
ECA	European Corporate Network Access
ECC	European Country Code
ECTRA	European Committee on Telecommunication Regulatory Affairs
EN	European Number
ENTF	European Numbering Task Force
ESC	European Service Code
ESI	European Service Identity
ESN	European Subscriber Number
ETNS	European Telephony Numbering Space
ETO	European Telecommunications Office
GSN	Global Service Number
ITU-T	International Telecommunications Union - Telecommunications Standardization Sector (formerly CCITT)
NDC	National Destination Code
SN	Subscriber Number
UNI	User Network Interface
UPT	Universal Personal Telecommunications
UR	User Reguirements

4 Structure of pan-European service numbers

4.1 Numbering scheme

Two schemes were proposed to create the ETNS:

1) the use of a specific Country Code assigned to Europe (ECC-388);

2) the use of national numbering resources.

The 7th November 1996 decision of ECTRA opts for a scheme based on a European country code. This means that a scheme based on national numbering resources is not now being actively pursued. The Human Factors issues associated with the national numbering resource option only are contained in annex A.

4.1.1 European Number (EN)

To implement the European Country Code scheme the allocation of a specific country code is required. The country code is a country code used to identify not a specific country but a set of services provided on a pan-European basis (ECC). Figure 1 describes the structure of the ETNS number based on the country code scheme.

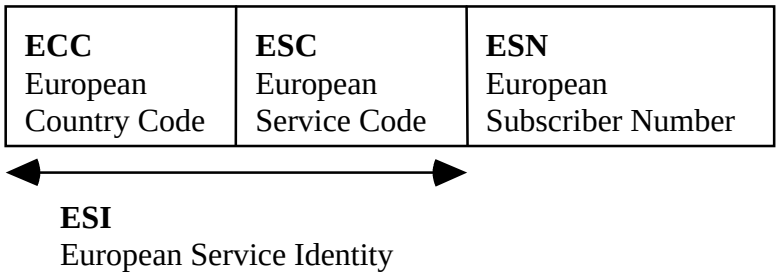

Figure 1: European Number - CC scheme

The structure of the EN should not preclude evolution towards a global numbering scheme on a per service basis where this is a requirement.

ETNS shall be designed to have a minimum of 100 European services and a potential of 10 million subscribers per service if required.

The total length of the number shall not exceed 15 digits.

4.1.2 European Service Identity (ESI)

An ESI is assigned to a service or a family of services in some specific cases.

In the country code scheme, an ESI begins with the country code allocated to the ETNS (388). The length of the ESC can vary between 1 and 4 digits. Examples of ESIs are:

- 388 3;
- 388 25;
- 388 326;
- 388 5432.

The length of the ESIs can either vary with a minimum length of 4 digits (e.g. 388 2) and a maximum of 7 (e.g. (388 2345). In this country code scheme, there is no problem to find a hundred ESCs.

There must not be any indication of service provider in the ESI.

Examples of ESIs for the National Destination Code (NDC) scheme are given in annex A.

4.1.3 Subscriber Number (SN)

The structure and length of the SN depends on the service, mostly according to the number of service providers and to the number of expected subscribers.

Initially the number's length is fixed for any given service, the use of variable length numbers is for further study.

To reach the goal of 10 millions of subscribers, the SN must be at least 7 digits long. When combined with a 5 digits ESI, this gives a minimum of 12 digits ETNS number.

For some services the SN is not required e.g. access to information services or services that require 2-stage dialling.

The subscriber number can be either structured or unstructured.

5 Corporate telecommunication networks

Annex B of a draft TR being prepared by ETSI TC NA with the work item number DTR/NA-021408 identifies options for numbering corporate networks under both the candidate numbering schemes. The European country code option allocates a single digit (e.g. 5) after the country code to form a European Corporate Network Access identity (ECA identity) that indicates that the number belongs to a corporate network. In the national numbering option an existing country code and an unused National Destination Code (e.g. 00) is used (e.g. this could give an ECA of 3885 for the country code option or 4900 for the national numbering option).

Both options use a 10 digit subscriber number comprising a 2 to 7 digit Corporate Network IDentity (CN_ID) that identifies the specific corporate network followed by 3 to 8 digits identifying the specific addressable entity. Future extension of this scheme can be implemented by using an 11^{th} digit in the subscriber number that would take the number length up to the 15 digit limit in ITU-T Recommendation E.164 [2].

A significant difficulty of this scheme is the need to determine how many corporate networks will be required and how many specific addressable entities each network can accommodate. Those corporate networks that require a large number of specific addressable entities must have short CN_IDs and those requiring fewer specific addressable entities can be allocated longer CN_IDs. The Draft TR proposes a method of allocating a number of different length CN_IDs that postpones any irreversible decisions on the total number of CN_IDs of each length that can be provided to the latest possible time.

Although this scheme minimizes the problems of pre-determining the demand for different length CN_IDs it does not seem to have any mechanism to cope with the changing demands due to major corporate reorganizations. If a company were to rapidly expand as a result of a series of acquisitions it might easily require more specific addressable entities than can be allocated with the length of CN_ID that it was allocated (within the 14 or 15 digit limit). A company that de-mergers might require one or more extra CN_IDs instead of the original one it was allocated. In addition its original CN_ID may now allow far more specific addressable entities than it now needs - thus wasting valuable numbering space. Such movements, that are all too common in today's global economy, could rapidly lead to major problems in the efficient allocation of numbers in the numbering space assigned to corporate networks.

6 Number length issues

6.1 User dialling difficulties

Some of the schemes for moving from pan-European services to global services may result in longer European numbers and these will reach the ITU-T (ITU-T Recommendation E.164 [2]) limit of 15 digits. Given the difficulties in allocating codes to corporate networks discussed in clause 5, it is likely that European corporate network numbers will be longer than other ETNS numbers and, in some European countries, longer than existing national numbers and longer than existing corporate network numbers. This increased number length, to 14 or 15 digits, will mean that corporate network numbers will be amongst the most difficult for users to dial and to remember.

The corporate network number length problem will only apply to people outside a corporate network trying to access someone within it. For internal calls within a corporate network, people will only have to dial abbreviated codes, and these need be no longer than codes used in any similarly sized corporate network not using European numbers.

Identification information, to the called and calling party, will always be the full European number. Small corporate networks may suffer most as their identities may be very much greater under an ETNS than under a national scheme. However, this will be compensated by the replacement of a multiplicity of identities with a single identity for each user.

There is very good evidence that dialling accuracy will decrease significantly with number length. Studies were conducted with people immediately recalling and dialling, in the correct order. The numbers were either spoken or were shown on a screen for a period equivalent to the time taken to speak them (e.g. a 6 digit number was displayed for 3 seconds), These experiments produced the following results:

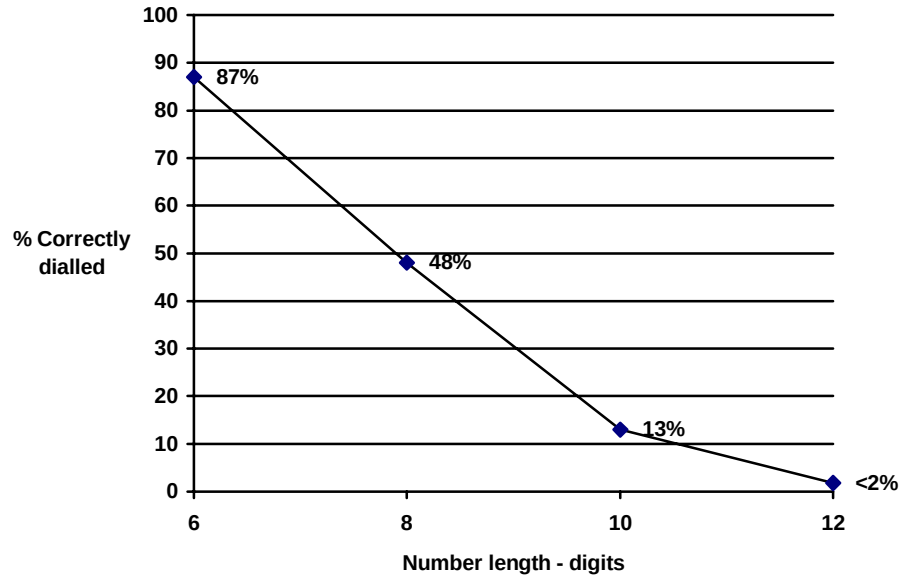

Figure 2: Accuracy of dialling telephone numbers as a function of number length Nordby et al., 1996 [4]

As a result of this difficulty in memorizing and dialling long numbers, users adopt other strategies (e.g. writing down numbers and using memorization improving strategies) in order to improve their ability to accurately dial such numbers. Nevertheless, the results represent the combined effect of at least two factors:

- the approximately arithmetic increase with number length of the probability of at least one correctly memorized digit being incorrectly dialled;
- the very much more rapid decrease with number length in the ability of people to keep the number in their short-term memory.

As numbers increase in length and become difficult to memorize the incidence of call set-up being terminated by inter-digit timeouts is likely to increase as users repeatedly refer back to printed or written telephone numbers.

Estimating the limits of people's short-term memory is notoriously difficult as it is critically dependant on a number of factors that include:

- the type of item being memorized;
- how that item has been presented to the individual; and
- differences between individuals.

The most frequently quoted estimate for a short-term memory limit is 5 to 9 chunks of information (Miller, G.A., 1956 [3]). This is now regarded with much caution as it is exceptionally difficult to determine what a "chunk" of information is and the original study related to the specific case of verbal recall of visual stimuli consisting of non-words rehearsed in human short-term memory.

If someone had to dial a telephone number such as 00388522759763456 (the maximum length of a corporate network number if the 15th digit came eventually came into use) they would find it impossible without having the number broken down into smaller groups. To aid the user, telephone numbers are usually broken down into logically significant groups of digits such as the international prefix, the European corporate network access code, the corporate network identity and finally the number identifying the specific addressable entity e.g. 00 3885 272 52273456. This grouping has a clear benefit in aiding the user to read the digits from the page. In addition, where these groups of digits are very familiar e.g. the international prefix and in the future perhaps the European corporate network access code, they might be treated as "chunks" by the short-term memory.

It is also common practice to further divide logical blocks of the number into shorter groups e.g. 52273456 might be presented as 52 27 34 56. This again can improve the ease with which the number can be read from the page. In some cultures, users have become accustomed to remembering groups such as "double two" and grouping into regular groups of two digits may interfere with this e.g. in grouping a number as 52 27 the user is unlikely to spot the repeated digit 2 which might be more easily memorized as "five double-two seven". For printed material, the issue of how a number should be presented is addressed in ITU-T Recommendation E.123 [6].

6.2 Migration to a global numbering scheme

In clause 4 it is shown that in either of the two numbering schemes, the number length can be constrained to 12 digits in length and still meet the requirements of up to 100 services and up to 10 million subscribers. One possible scenario is that a services implemented as a European service may be migrated to a global service numbering scheme. There are two options for how such a migration could be implemented.

The first option is for the whole European number to be added after the new global service country code. If the previous maximum number length were restricted to 12 digits this would still lead to a situation where the number length would be increased by 3 digits to a minimum of 15 digits. Such a long number (as a minimum) is clearly not very desirable for service users e.g. "388 5 service number" would change to "nnn 388 5 service number"

The second option is to embed the European Service Number (ESN) in the Global Service Number (GSN) and add it after the global service country code. An additional digit might need to be added in front of the ESN to form the GSN but this would still mean that the number length could be kept to a 12 or 13 digits (minimum).

Both options retain significant parts of the original European Number, which will aid users. Both schemes introduce a new global service country code to the user, which will be something new and unfamiliar for them to learn. The second option is far better from a Human Factors perspective because of the much shorter number length, with the advantages outlined in subclause 6.1.

6.3 Migration of corporate network numbering

The ECTRA decision to base the ETNS on the 388 country code eliminates the potential user confusion that would have been caused by migrating corporate network numbers from a national numbering based scheme to a country code based scheme (see annex A).

The difficulties of migrating corporate network numbers to a global scheme are the same as described in subclause 6.2. They will, however, be at the longest end of the range of number lengths, for the reasons described in clause 5 and subclause 6.1, and hence they are likely to be the most difficult for users to deal with if migrated to a global numbering scheme.

7 Number portability issues

Number portability for pan-European services has been defined as a feature that allows a customer of a pan-European service to change the Provider of this specific service retaining the same ETNS number. This definition does not allow changes between different pan-European services whilst retaining the same number.

Two Human Factors requirements for number portability of ETNS numbers are:

- the user's ability to determine the charge of a call should not be affected by a change of service provider for a European number;
- calling parties should not be able to recognize that they are calling a number supported by an alternative service provider.

The first requirement implies:

- either full harmonization of calling charges for each type of service across all network operators;
- or sophisticated mechanisms for apportioning costs between the various parties (the user, the service provider, network providers, etc.) that result in the charge to the user always remaining the same;
- or guaranteed methods of communicating call charge changes to users in a way that does not identify this change with the fact that the service provider of a number has changed.

It should not matter to the user what underlying mechanism is used if the requirement for keeping charges predictable is fully met.

Given the fact that charging to the user will not be affected solely by the change of service provider, the user does not need to be aware that the change has taken place. The second requirement supports this viewpoint and avoids valueless information being communicated to the user resulting in the overuse of the limited means of user feedback (e.g. tones, messages, etc.).

In addition the second point implies that when calling a number that has been moved to an alternative service provider, the user should encounter no other unnecessary overheads due to, for example, a restriction or limitation of supplementary services, confusion or lack of comprehension of tones or announcements. Again these implied requirements are very desirable from a Human Factors viewpoint.

For privacy reasons, the service subscriber may also require that a change of service provider supporting its European number will not be detected by the end-user of the service. This is an identical requirement to one of the previously listed user requirements.

8 Identification of European services

A European country code acts as a very clear signal that the number containing it is a pan-European service. A scheme that used national numbering resources would run a very serious risk that users would fail to identify that the called number is a pan-European service and that they will assume that it is an ordinary national number of the appropriate country. Further number identification issues for an NDC based scheme are contained in annex A.

In European services where the calling party has a European number (e.g. a European UPT), it is an important user requirement that the CLI information presented to the called party is the calling party's European Number and not the telephone number of the location from which the telephone call originates. There may need to be an exception to this user requirement for the instance when the called party is an emergency service, where it may be vital to know the physical location of the calling party.

9 Identification of charging

With the increasing diversity of services and special charging regimes on offer, it is getting increasingly difficult for users to identify what the call charging rate will be from studying the number. In the longer term there may need to be different ways of indicating call charging rates to users, but for now it is still possible to make some use of the number structure.

At present there is one fairly universal rule, that any calls preceded by an international prefix will be charged at much higher international charge rates. In both the proposed numbering schemes, pan-European services will need to be prefixed with an international prefix. However, different services will be charged at potentially very different rates - some possibly as high or higher than international rates and some significantly lower. If users are able to identify:

a) that the service is a pan-European service;

b) what type of service it is,

they may be able to infer the appropriate charge rate. If users mis-identify the call as an ordinary international call, they will almost certainly be incorrect in their inferred charge. It is thus important that the user can clearly identify the type of service and that the service is a pan-European service. Various numbering options that improve the clear identification of pan-European services have been discussed above.

10 Routeing options

The draft routeing TR identifies a very diverse range of routeing options for pan-European services. These are too diverse to re-iterate in this document, but it is possible to identify two usability criteria that can be used in evaluating the merits of the different routeing options. These usability criteria are:

a) Call set-up times should not be made unduly long as a result of very complex routeing methods.

b) The variability of call set-up times should not be too great.

Many of the routeing options involve passing the numbering information from one country to another and they may also involve several stages of number translation. Although modern digital telecommunications systems typically perform routeing operations very swiftly, a succession of these may still take some time. These delays would mean that it would take a longer time before tones were returned to the calling party.

There is no Human Factors imperative for a zero length call set-up time as this can cause users of certain terminals such as mobile telephones to fail to hear the start of the called party's response. However delays greater than 0,5 seconds before the return of a tone or message to the user may lead users to presume call failure and to a correspondingly high number of falsely terminated call attempts.

Where a tone or message can be returned, users may be prepared to tolerate longer delays - dependant on the importance of the call and the effectiveness of the tone or message in implying the potential for a successful outcome.

At least as important as the absolute value of delay is the variability of the delay. There is solid evidence that users can cope with consistently longer delays far better than they can with delays that randomly vary from very short to very long. It is possible that if routeing options cause some calls to be routed via more than one country and some to be routed within the calling country, the variability of the delays might be very great. This would mean that each different service might have a different set-up delay and that there might also be scope for delay variations even within one service.

If absolute delays are kept low e.g. less than 0,5 seconds, then the variability factor can probably be ignored. Where longer delays occur, which would need to be accompanied by tones or messages, the delay should not vary by more than a specified amount e.g. ±30 % of its mean value.

11 Linguistic problems with ETNS services

A TR addressing the ETNS is expected by the end of 1997 from TC NA and will concentrate on the provision of the infrastructure for providing ETNS services. In order to understand the appropriateness of this infrastructure it is necessary to consider the practicalities of providing services over the ETNS.

The ETNS documents to date propose a number of potentially viable solutions to the numbering issues but they do not, and cannot, address the highly important cultural and linguistic factors. The linguistic factor is almost absent in the US (as even in Spanish speaking communities English is also universally understood).

At present services such as television shopping channels often advertise a range of different numbers to access the service from different countries. Although this is often necessitated by the technical restrictions that the lack of an ETNS brings, it does make it very easy to offer the majority of callers a service in the language that they understand.

It is clear that certain services that do not depend on language, such as pure data transport services, will be easy to implement Europe-wide. It is also likely that the ETNS will provide a simple direct benefit to corporations trying to deploy corporate networks, as addressing cultural and linguistic differences is already an inherent factor in the day-to-day running of multi-national European corporations.

When discussing global versus regional numbers, the Green Paper on a Numbering Policy for Telecommunications Services in Europe [5] says:

> "Although many products are available world-wide, their sales, marketing, and customer support activities are usually organized on a regional basis for cultural, linguistic and logistical reasons, ...".

Although much of this statement is clearly correct, it becomes difficult to see how linguistic barriers are less in implementing European rather than global solutions. There are many instances where the linguistic barriers in a global solutions may be relatively less than would exist in a European solution. For example, an English language service

would be applicable to all the countries where English is the most widely understood language (the UK, the USA, Australasia and many other parts of the world) whereas in Europe only the UK and Ireland would find this service easily usable. Similarly the market for a Spanish language service would be much greater if available in South America and the many other Spanish speaking countries than it would be if it were restricted to Europe.

Although the ultimate solutions may lie with service providers, it is necessary to see how these linguistic barriers could be overcome in order to ensure that European services are able to reach their full potential. The solutions would appear to fall into three broad categories:

- the service language is selected according to the country code of the originating call (based on CLI);
- the user selects the service language after accessing the service (by means of a menu system);
- separate service numbers for different languages.

This first option would appear to have very few merits and could fairly easily be discounted as:

- many countries have a number of different languages and hence the language might not suit the caller;
- the person accessing the service may only be visiting the country and may speak a different language;
- the total range of languages that would need to be supported (by human operators or software systems) is impracticably large.

The second option that involves the user making a choice after accessing the service is undesirable as it will significantly add to the complexity and the inefficiency of the user interface to the service. This effect is likely to annoy customers and may cause them to experience difficulties in using the services. If only a very limited range of languages, say 3, were supported this option might be more acceptable.

The most practical solution would appear to be the offering of a range of different service access numbers covering the most common European languages only. Although similar to the present implementations used by television shopping channels, the service provider would no longer need to provide different numbers for countries that shared a common language and customers could select a number that suited them no matter which country they were calling from. The only problem with this solution is that it uses up the total range of service numbers at a much higher rate than either of the alternatives.

12 Usability testing

As candidate technical realizations for implementing an ETNS become clearer it will become essential to evaluate the possible impact on potential users of accessing and using these services. As the Green Paper on a Numbering Policy for Telecommunications Services in Europe [5] states:

> "Furthermore, users must be closely involved in the formulation of a long-term numbering strategy for Europe, and where changes are necessary, a proper assessment must be made of both the costs involved and the benefits which will follow for both business and consumers".

In this TR a number of potential Human Factors issues have been raised. In many cases it has not been possible to give a precise indication of the absolute or relative importance of these issues and the impact that they would have on the usage of European services.

Examples of the issues that have been raised but where it has been impossible to give a precise indication of the impact these effects would have on the operation of the ETNS are:

- the negative impact of potentially long ETNS numbers;
- the ease with which user will be able to identify European service numbers;
- the expectations that users will have with regard to the charging of the various services;
- the effect of delays in call set-up and variations in those delays.

There is a need for a clear comparison of the relative values of the these different Human Factors/usability issues. It might be possible to present a relative scoring system with weightings for different scenarios.

The "Second ECTRA Decision Regarding A European Telephony Numbering Space" (ECTRA/DEC(96)01-E) recommends "that consideration of user friendliness shall prevail when implementing the ETNS". This appears to mean that "user friendliness" should prevail over all other considerations. Thus, the assessment of "user friendliness" should be an integral part of the development of an ETNS and it should begin as early as possible.

TC-HF has the opinion that it is important that usability testing takes place well in advance of any final roll-out of an ETNS to enable potentially major issues related to how the ETNS is implemented to be addressed without incurring substantial re-engineering costs. The testing of these HF/usability issues will enable their relative importance to the market/s to be tested. The tests would enable meaningful judgements to be based on experimental data.

13 Issues and recommendations

A number of issues are raised in this document. The following list gives these issues and the material in the body of the document gives the background to them:

a) the scheme for allocation of Corporate Network Identities (CN_IDs) does not make it easy to cope with major corporate re-organizations e.g. mergers and de-mergers (clause 5);

b) dialling difficulties and problems with inter-digit timeouts may be a problem due to the length of some European Numbers (subclause 6.1);

c) linguistic problems may be experienced in some European services (clause 11).

A number of recommendations are made in this document. The following list gives these recommendations and the material in the body of the document gives the background to them:

a) embedding the European Service Number (ESN) in the Global Service Number (GSN) and adding it after the global service country code should be used in preference to adding the whole of the European Number (EN) after the global service country code (subclause 6.2);

b) the user's ability to determine the charge of a call should not be affected by a change of service provider for a European Number (clause 7);

c) where a person is contacted by someone dialling from a service using a European number the CLI information should present the European number and not the number of the originating line (where the called party is an emergency service the calling location should also be obtainable) (clause 8);

d) call set-up times should not be made unduly long as a result of very complex routeing methods (clause 10);

e) the variability of call set-up times shall not be too great (clause 10);

f) usability testing should be carried out before an during the development of an ETNS (clause 12).

Annex A:
Country code based scheme (NDC scheme)

A.1 European Number (EN)

The national numbering resource scheme would be based on the use of the national numbering resources of various European countries to create a common European numbering plan to be used for the provision of pan-European services.

Figure A.1 shows the possible structure of ETNS number based on the national numbering scheme. The CSSC is a spare National Destination Code used to in conjunction with the CC to identify a specific pan-European service.

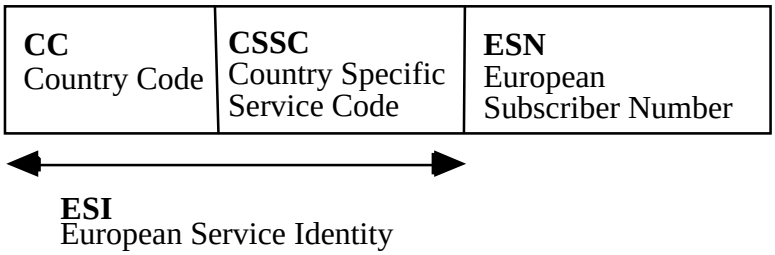

Figure A.1: European Number - NDC

It would always be dialled as + EN (international prefix before the number). In the NDC-scheme, national dialling could not be allowed, otherwise the user would miss the European branding of the service. In any case, the NDC will usually be chosen so that such dialling is impossible, e.g. NDC begins with 00.

Although the total number length shall not exceed 15 digits, it would have to be limited to 12 digits if evolution towards a global scheme were implemented by adding a country code in front of the original European Number (see below).

A.2 European Service Identity (ESI)

An ESI is assigned to a service or a family of services in some specific cases.

In the country code (NDC-scheme) scheme, an ESI begins either with the country code of a European country preferably followed by the 00 within the national numbering scheme.

The block of numbers reserved for the service must be unassigned in this country. This is always the case when its NDC begins with 00.

Different services can have ESIs beginning with different country codes. The country designated by the country code may have no link with the realization of the service, e.g. calls are not necessarily routed to that country.

In the NDC-scheme, as there are a little more than 40 European countries, it will be possible to reach the goal of 100 services only if each country reserves several CSSCs, e.g. 00x.

Example of ESIs are (33 or other) 00 (x(y)).

The length of the ESIs can either vary with a minimum length of 4 digits (e.g. 33 00) or be fixed to five digits with a CSSC = 00 for a three digits country code, and CSSC = 00x for a two-digits country code.

There must not be any indication of service provider in the ESI.

A.3 Corporate telecommunication networks

Annex B of DTR/NA-021408 [1] identifies options for numbering corporate networks under both the candidate numbering schemes. In the national numbering option an existing country code and an unused National Destination Code is proposed (e.g. 00) is used (e.g. 49 00) to form the European Corporate Network Access identity (ECA identity).

The issues on allocating numbers to different corporate networks in the NDC scheme are identical to those in the country code scheme, as described in clause 5.

The problems of moving from a corporate ETNS number in a scheme based on national numbering resources to one based on a European country code would be major. Unless the combination of the Corporate Network Identity (CN_ID) and the digits that identify the specific addressable entity were restricted to the unrealistically low value of 7 or 8 digits, the option of combining the country code and the country specific service code and adding them after the new European country code would lead to unacceptably long numbers up to 18 digits long. This would indicate that the only possible migration path for corporate network numbers would be to completely alter the ECA identity from something like 49 00 to something like 388 5, with the consequential confusion to users discussed in subclause 6.2.

A.4 Public network numbering

In clause 4 it is shown that in both the NDC and CC numbering schemes, the number length can be constrained to 12†digits in length and still meet the requirements of up to 100 services and up to 10 million subscribers. One possible scenario was that a scheme based on national numbering would be implemented first and services would subsequently be migrated to a scheme based on a european country code. There are two options for how such a scheme could be implemented and they both have disadvantages for users.

The first option is for the country code and the country specific service code to be combined and added after the new european country code. if the previous maximum number length were restricted to 12 digits this would still lead to a situation where the number length would be increased by 3 digits to a minimum of 15 digits. Such a long number (as a minimum) is clearly not very desirable for service users.

EXAMPLE 1: "33 00x service number" would change to "388 33 00x service number".

The alternative option was to create a new European service code and add it after the European country code. This would mean that the number length could be kept to the more desirable 12 digits (minimum).

EXAMPLE 2: "33 00x service number" would change to "388 yz service number".

The disadvantage of this scheme would be that the new European Service Identity (ESI) (e.g. 388yz) would bear no relationship whatsoever to the previous ESI (e.g. 3300x). In the short term this would cause some difficulties for users as previously learned service codes meanings would no longer be meaningful and new codes would have to be learned. The Human Factors issue is to weigh the short term difficulty of completely changing codes against the long term difficulty of having to cope with much longer service numbers and decide which would be the overall better option for users.

Many of the schemes for moving from pan-European services to global services may also result in longer service codes and these will reach the ITU-T (ITU-T Recommendation E.164 [2]) limit of 15 digits.

A.5 Identification of European services

A scheme that used national numbering resources would run a very serious risk that users would fail to identify that the called number is a pan-European service and that they will assume that it is an ordinary national number of the appropriate country.

Any scheme that relied on national numbering resources would require each country to assign one or more unused digits from their national numbering resources to allocate to service codes. If these unused digits varied from country to country it would be very difficult for users to identify anything unique about the set of European service identities.

One of the possible options for the use of national numbering resources, that was mentioned in some of the other draft TRs on numbering involves allocating the same country specific service codes starting with "00" (being just "00" for

countries with 3 digit country codes and "00x" for countries with 2-digit codes). If sufficient countries were to participate in this scheme it would be possible to accommodate the 100 codes that would be needed in a viable ETNS. This option has the great merit that all European service identities would have "00" as the 3rd and 4th or 4th and 5th characters of the number. This pattern might have proved to have been an easily identifiable characteristic of a pan-European Nnumber.

A.6 Masking

In an NDC based scheme there is every danger that users will identify the country code in the number and assume that it is a normal international number and not an ETNS number. This might lead them to expect normal international call costs and to make assumptions about the location and language of the called party.

By formatting the presentation of the number in an appropriate manner it may be possible to "mask" the country code and override this danger. For example, a code based on UK national numbering resources could be presented as 00 440 02 34 56 78 instead of 00 44 00 23 45 678. It is unclear to what degree this would alleviate the problem and it would be difficult to ensure that everyone presenting the numbers used the masking format.

History

Document history		
V1.1.1	June 1997	Publication

ISBN 2-7437-1458-1
Dépôt légal : Juin 1997