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Foreword

This ETSI Technical Report (ETR) was produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

NOTE: ETSI TC SMG has not been consulted at this stage. It is, however, likely that the provision of advanced mobile services in a global perspective by Global System for Mobile communications (GSM) and later Universal Mobile Telecommunications Systems (UMTS) will induce some requirements in the area of numbering. TC SMG will in due time report on such requirements.

Introduction

This ETR provides the details of a study of alternative solutions and implications in the European background, on the creation of a European Telephony Numbering Space (ETNS).

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1 Scope

This ETSI Technical Report (ETR) describes the history related to the "European Numbering", the background and the trend from its creation, at the beginning of 1990, until October 1994, when the European Committee of Telecommunications Regulatory Affairs (ECTRA) drafted a position to reach a common numbering space for all the European countries and provides an overview of the implications related to the creation of a European Telephony Numbering Space (ETNS).

No Corporate Telecommunications Network numbering issues were identified or considered by NA2 when producing this report because the consultative exercise concentrated on public network aspects. ECMA TC32 and ETSI TC BTC were therefore not consulted at this stage. Future consultation on CTN numbering and addressing aspects is assured.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] Council Directive 90/387/EEC: "of 28 June 1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision".
- [2] Council Directive 90/388/EEC: "of 28 June 1990 on competition in the markets for telecommunications services".
- [3] Council Decision 91/396/EEC: "of 29 July 1991 on the introduction of a single European emergency call number".
- [4] Council Decision 92/264/EEC: "of 11 May 1992 on the introduction of a standard international telephone access code in the Community".
- [5] Council Resolution 92/C 318/02: "of 19 November 1992 on the promotion of Europe-wide co-operation on numbering of telecommunications services".
- [6] CCITT Recommendation E.164: "Numbering plan for the ISDN era".
- [7] ITU-T Recommendation E.165: "Timetable for coordinated implementation of the full capability of the numbering plan for the ISDN era (Recommendation E.164)".
- [8] ITU-T Recommendation E.168: "Application of E.164 numbering plan for UPT".
- [9] ETR 134: "Network Aspects (NA); CEC initiatives on a unified European numbering plan".
- [10] ETR 144: "Universal Personal Telecommunication (UPT); UPT phase 1; Numbering, dialling and evolution for incall".
- [11] ETNO Questionnaire on availability of common numbering space in European countries.

3 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

CC	Country Code
CEU	Commission of the European Union
EAC	European Access Code
ECTRA	European Committee of Telecommunications Regulatory Affairs
ENF	European Numbering Forum
ETNS	European Telephony Numbering Space
GSC	Global Service Code
GSM	Global System for Mobile communications
NDC	National Destination Code
ONP	Open Network Provision
SG	Study Group
SN	Subscriber Number
TSB	Telecommunications Standardization Bureau
UMTS	Universal Mobile Telecommunications Systems
VPN	Virtual Private Network

4 European numbering background

European numbering initiatives started after the Commission of the European Union (CEU) Directives on Open Network Provision (ONP) (Council Directives 90/387/EEC [1] and 90/388/EEC [2]) where the networks were requested to be opened to competition. In particular, no limitations in any telecommunication environment should occur as a result of numbering policies.

The CEU then set up consultation studies on the feasibility of a common European numbering plan.

Council Decisions 91/396/EEC [3] and 92/264/EEC [4] were first developed and then Council Resolution 92/C 318/02 [5] was produced, in which the national numbering schemes are requested to work towards a new harmonised European numbering plan.

4.1 CEU initiatives

The CEU initiatives include Council Decision 91/396/EEC [3] on the introduction of a unique European number for emergency calls (112), as already recommended by the CEPT in the T/SF1 of 1976, and the adoption of the international prefix "00" (see subclause 6.2.3).

The basis for the European co-operation on European numbering is Council Resolution 92/C 318/02 [5]. This Resolution requests co-operation at the European level on numbering arrangements, facilitating the development of common European positions in relation to global numbering developments, and the creation of a ETNS.

The European countries were invited to co-ordinate within CEPT and to co-operate with ETSI in order to take full account of the link between standards development and numbering resource management.

The main scope of the studies are summarised below:

- to study the introduction of a European area code to be used in parallel with the existing European Country Codes (CCs);
- to propose solutions for the creation of a European numbering space;
- to define procedures for the administration and management of such European numbering.

Potential pan-European services identified by the Resolution are listed below:

- European numbers for all Europe;
- flexible routing;
- Europe-wide Freephone numbers;
- Europe-wide kiosk billing service;
- Europe-wide shared cost services;
- Europe-wide mobile services.

such a Resolution has many consequences in Europe for CEPT, ECTRA, ETSI, ETNO and also European user associations.

Subclause 4.2 provides an overview of the activities, initiatives and positions of each party leading up to the recent proposals for the creation of the European Numbering Forum (ENF).

4.2 CEPT and ECTRA initiatives

ECTRA is a committee within CEPT. The members are the national regulators from all the European countries.

In 1992, a Project Team on numbering was created within ECTRA to work on numbering issues. One of the first tasks taken up by this project team was to study the proposals coming out from the Council Resolution 92/C 318/02 [5].

ECTRA has recently developed the document "Strategic Options for Numbering of Telecommunications Services in Europe". This document presents four different options for future development of numbering in Europe. The document is sent out on public consultations in all the ECTRA countries. It is expected that the national consultation periods will be finished by the first quarter of 1995.

4.3 ETNO position

In 1992 ETNO set up a specific group on numbering issues (ETNO-NI), with the mandate of formulating common positions between telecommunication operators within Europe, representing the liaison between the operators and other European bodies related to telecommunications.

The general position of the group is to resolve the need for common codes with world-wide solutions instead of European ones, because of the shortage of Common European Numbering Space (CENS) and the difficult operation in reviewing national numbering plans.

4.4 ETSI Position

ETSI has studied standardization aspects of European numbering (according to its mandate), within the Technical Committee Human Factors (TC-HF), regarding access procedures to services, and within the Technical Committee Network Aspects (TC-NA), regarding network aspects.

Their initial position on the European Access Code (EAC) is that before support could be offered for this initiative, detailed studies on real benefits, tariffs routing configurations and costs are needed.

4.5 ITU consideration

In April 1992, CEC DG XIII requested the opinion of the CCITT on the possible request for a CC to be used for European purposes.

The CCITT, starting the new study period as the ITU-T, declared that this problem had to be studied by its competent fora, i.e. Study Group 2 (SG 2), and stated that CCs are precious resources that can only be assigned after careful consideration, in order to avoid code exhaustion.

For the first time, in April 1993, the parties involved in European numbering (i.e. ECTRA, ETNO, ETSI, and CEU) met in Budapest under the chairmanship of the ITU-T SG 2 chairman, in order to clarify the position of each group and identify possible evolution paths for European numbering.

This meeting started the framework of co-operation and, in principle, created the European numbering co-operation, recently termed the ENF.

4.6 ENF

The ENF has been established following the Resolution of the Council of Ministers on Europe-wide co-operation on numbering of telecommunications services (Council Resolution 92/C 318/02 [5]). It is a forum for the exchange of information and expertise, co-ordination and consultation, discussion and common studies on European numbering, addressing and related issues.

Its creation should ensure that the views of all parties that carry a relevant interest in numbering and addressing on a European level are taken into account. The ENF can forward proposals, recommendations and reports to ECTRA for decision or other members of the ENF for action. ENF conclusions on European numbering issues will be made by consensus.

5 ETNS; an overview of needs, use and implications

Worldwide telephony numbering plans need to adhere to the CCITT Recommendation E.164 [6] numbering plan, the structure of which requires each country to be identified by a specific **CC**, followed by a **National Destination Code (NDC)** and the **Subscriber Number (SN)**. Access to non-geographic services is normally through the use of a NDC allocated to that specific service. Across countries the choice of that NDC has varied to such a degree that the allocation of a common code within all national numbering schemes for accessing global services is not possible. This situation has been fully recognised within the world standardisation bodies and within the ITU-T¹⁾ and in the future CCs will be allocated to identify either a country or geographical area, or deemed to be **Global Service Codes (GSCs)**. These will be used to access global services and will precede the NDC and/or SN element of the number, as well as facilitating global number portability for these services.

Accessing pan-European services suffers from the same problems with lack of commonality of available codes throughout the European states. A common ETNS does not exist at the national level. Attempting to overcome this by making major changes to national numbering schemes is expensive and may be unwelcome to users, who have to bear the cost as well as considerable inconvenience.

1) ITU-T (previously known as CCITT) is the Telecommunications sector of the International Telecommunications Union.

5.1 The need for an ETNS

When considering the need for an ETNS the following factors should be taken into account:

- a) the CEU view of numbering as a key enabling mechanism towards their goal of liberalising the telecommunications environment in Europe and resultant actions;
- b) the demand for pan-European services;
- c) cost issues;
- d) capacity;
- e) political goals.

Each is considered individually, in subclauses 5.1.1 to 5.1.5.

5.1.1 The CEU view, resultant actions and its likely impact

In order to understand the views of the CEU it is useful to look at the background to this issue. In 1991 the CEU commissioned studies focusing on the possibility of harmonising numbering and addressing schemes across member states. An independent consultancy was given the task of reviewing the situation including the possibility of harmonising CCITT Recommendation E.164 [6] numbering across Europe, and documenting the current situation within national numbering schemes²⁾. This identified three mechanisms for CCITT Recommendation E.164 [6] convergence; developing National Numbering Schemes in an agreed manner, the harmonisation of new and emerging services, and the introduction of an integrated numbering scheme. A separate study was also commissioned by the CEU looking at the introduction of a European area code³⁾.

Since then, a Resolution of the Council of Ministers on the promotion of Europe-wide co-operation on numbering of telecommunications services has been issued (Council Resolution 92/C 318/02 [5]). An ENF is currently being set up, as called for in the Resolution, with ETSI being one of the initiating parties. In response to these actions, the Network Aspects (NA) Technical Committee of ETSI produced ETR 134 [9], which reviewed the current initiatives and noted that "for the CEC speed in opening up the current European market and the implementation of strategies to assist the competitive element appears to be the driving force, rather than a well thought out and measured approach". A number of recommendations were also made and agreed within ETSI, and have since been carried into the discussions aimed at setting up the ENF. The formation of the ENF is viewed as a positive step by ETSI in facilitating open discussions, between all representative bodies in Europe that carry a relevant interest in numbering and addressing, with the aim of establishing common positions for the benefit of all wherever possible.

The consultative exercise that is now to be conducted by ECTRA on their "Strategic Options for Numbering of Telecommunications Services in Europe" document during the period of late 1994/ early 1995, is also welcomed as a positive step in the process of formulating the medium and long term strategic direction for European numbering. Concern does exist however over the time table set for such an important exercise, and it is the view of ETSI that due to this constraint the required level of understanding needed to fully understand and address issues of this magnitude, will not always be reached. This concern is very similar to that which was referred to in the earlier ETSI ETR (see preceding paragraph) where once again speed appeared to be the prime requirement. Such an approach is difficult to understand as progress in most instances can only be made with ITU agreement and the current review of CCITT Recommendation E.164 [6] numbering and potential CC exhaustion being undertaken within SG 2 will not be completed before 1996 at the earliest. Any attempt by European delegates to force the issue will almost certainly result in failure and could "harden" opinion against any proposals.

2) Ovum report to the CEC DGXIII "A study on a telecommunications numbering policy for the European community" June 1992.

3) Coopers Lybrand and Deloitte "Report on the introduction of a European Area Code".

It is the view of ETSI that if new regional codes are to be advocated by Europeans within the world numbering fora, then the introduction and use of this concept by other parties has to be accepted. Such acceptance would require agreement on a number of fundamental points such as:

- what constitutes a "region"? - is it an identifiable land mass, a group of countries with a common interest, a group with common ethnic or religious backgrounds, etc.?

Without such clarification many difficult situations are likely to occur.

5.1.2 The demand for pan-European services

A number of separate studies have focused on the question of whether there is a real need for pan-European services, the most recent being the report prepared for the CEU DGXIII on the potential opportunities afforded by an ETNS⁴⁾. While not covering specific numbering aspects, this studied the potential market demand and concluded that a general case did exist for pan European numbering in terms of Freephone, calling card, some shared revenue/costs services and UPT.

It was also noted that global services were preferred over regional (pan-European) services. The introduction of regional applications was supported however where they could be introduced in advance of global schemes, and could migrate to the global scenarios through an elegant transition with minimum impact. Support for the global schemes, rather than regional, also fully aligned with the ONP platform common position⁵⁾ which stated:

- "The ONP Platform supports the studies being undertaken to establish global solutions for the numbering of, for example, Universal Freephone Service and Audiotex, which are clearly more advantageous than a purely European solution".

Looking at the range of services for which the introduction of an ETNS is supported it is apparent that two of the main candidates are very likely to become established global service offerings in the near future due to current standardisation activities within the ITU-T. Work on the numbering Recommendation for the universal (global) international Freephone service is well progressed and is scheduled for approval at the ITU-T SG 2 meeting in August 1995. In the case of UPT, ITU-T Recommendation E.168 [8]⁶⁾, which contains a number of scenarios for introducing UPT, was finalised and approved during the last study period. Since then ETSI NA 2 has produced ETR 144 [10]⁷⁾ which sets out a smooth migration path for European operators from the base scenario, through possible national implementations to the global scheme with full global number portability.

A case could also be made for a pan-European numbering space to take account of the growth of Virtual Private Networks (VPNs), but this has been viewed in light of the changing telecommunications scene across the world. Global alliances are very much the scene, with European operators linking directly with operators from other world zones, or consortia being formed, which provide similar seamless service offerings to customers on a global basis. This realignment is likely to become a more dominant factor enabling operators to offer their customers the benefits of one stop shopping. Work on shared revenue and shared cost services is now underway in ITU-T SG 1 to produce global service definitions, with the numbering issues being referred to SG 2. Taking this into account with the user views and putting aside the political aspects, the demand for pan-European services on a stand alone basis looks very small.

4) "Potential opportunities afforded by a new European Telephony Numbering Space" Final report 20/04/94 by Mary Ann O'Loughlin and Stuart Sharrock.
5) The Open Network Provision Consultation and Co-ordination Platform (ONP-CCP) consisted of representatives from telecommunications organisations, users and service providers who set up a working party studying European numbering issues in 1993.
6) ITU-T Recommendation E.168 [8] was approved at the ITU Plenary meeting in Helsinki, Finland 1992.
7) ETR 144 [10] was approved by ETSI NA, Porto, 5/1994.

5.1.3 Cost issues

It is recognised that quantifying costs for numbering plan changes is always a very difficult task, although the importance of this issue cannot be expressed too strongly. The attention that recent national numbering plan changes have received underlines this point, much of it coming about as users realise that in the end they bear both direct and indirect costs. Attributing costs to network operators or service providers only masks the true picture from users.

At this point it is only possible to identify the magnitude of costs likely to be incurred. Direct cost will be incurred by operators (having to adapt their systems and networks), service providers and users. The cost to users should not be underestimated: as well as having to amend stationery, advertising, business cards etc., many will have to reprogram CPE in order to either access or bar service offerings using the new scheme. In many cases this will be an additional burden placed on them following recent (or planned) changes to their national numbering schemes. No matter how this is promoted, it is unlikely to prove a popular action.

Indirect costs relating to the lost opportunities if a pan-European scheme is not implemented are even more difficult to assess. Figures equating to several million ECU have been quoted, although a degree of scepticism remains. What has not been considered is how much of this is offset with the introduction of a global numbering space, particularly as the bulk of the current assessment appears to be based on the Freephone market.

Regarding future costs to the user for utilising pan-European services, a situation where there is little difference between these charges and the tariffs charged for global services could result. Whilst in the past telephony based charges have been distance related, with the decreasing cost of transport this may not be the case in the future.

5.1.4 Capacity

It is the opinion of ETSI that the development of European numbering schemes should be conducted in a manner that takes full account of good number scheme practice and recognises the benefit of having a stable scheme. Other key criteria include an adequate supply of numbers, longevity of the scheme and human factor considerations. Of these, the issue that is often brought to the forefront in support of a pan-European scheme is capacity. It is argued that its introduction would facilitate additional capacity over and above that provided by a global implementation, and prepare Europe for future contingencies. All numbers will come out of the CCITT Recommendation E.164 [6] pool of numbers and capacity limitations are either the result of limitations imposed by the number scheme structure, or exhaustion of a finite resource. The ITU-T will take account of both of these issues when developing their number plan exhaustion and CCITT Recommendation E.164 [6] revision programmes. There is no evidence to suggest that any regional scheme that sits within that framework can create additional capacity. In reality the opposite situation is more likely to occur as, with the advancement of technology and the rapid development of third world countries fuelling new markets, commercial horizons will rapidly be extended in order to take advantage of new opportunities. Numbering space that can only be utilised within regional boundaries may sterilise large chunks of capacity and provoke any potential situation of global number exhaustion.

It is also relevant to point to the fact that enormous potential numbering space exists within existing national schemes. Many countries do not utilise their full capacity by choosing to keep the length of the dialled digit string as short as possible.

The main question that has yet to be answered for Europe is "what capacity is required?". The emergence of global services possibly within the same time frame as the birth of regional services would obviously impact on any estimate. Flexibility is also key and should be given due regard when differing proposals are assessed.

5.1.5 Political goals

The political goals of the CEU are well documented and have been referred to in a number of Council Resolutions⁸⁾. ETSI offers full support for the CEC drive to ensure that numbering should not inhibit the ability to offer services on a pan-European basis, neither should it restrict competition. The level of support for the view that the numbering scheme should support a European identity remains questionable. It remains unclear what actually would constitute a European identity. There appears to be little substance for this from a user, standardisation or economic stand point. Currently only two areas of the world are recognisable regional entities within the CCITT Recommendation E.164 [6] scheme, North America who were allocated CC "1" and those countries of the former USSR who were allocated the code "7".

Claims that the North American market has benefited from the use of an integrated scheme have to be viewed in the right context. Whilst having continental status like Europe, the growth of telecommunications for each region has taken place in vastly different environments. One point often overlooked is that, in general, services in North America are currently only offered on a regional basis, making the transition to regional and global less onerous when compared with Europe which would end up with a three tier system, national, regional and global. Europe has to take account of the current situation and the fact that each European nation has a fully developed numbering scheme, which its people have grown up with over generations, cannot be ignored. Compared with America, the European community is still in its infancy and has yet to face a whole variety of problems which they never had to tackle, such as race, culture, language and monetary differences. Although a competitive environment exists in America, it has reached a stage where the focus for major growth in the telecommunications sector is in the global expansion of its services, exemplified by the North American push in Europe. With the drive for global services their main constraints in terms of numbering are the same as those for Europe. If Europe's main thrust is on a regional rather than global level as world markets open up, the prospects for long term growth and expansion could be damaged. Large advances have already been made in Europe. An excellent example was the successful launch of the Global System for Mobile communications (GSM) network. In terms of numbering its successful launch across Europe was achieved within the existing national numbering plans and application of ITU standards without any difficulties.

The break up of the former USSR has seen a number of states approach the ITU for codes outside of the "7" range. The resolution of this issue is currently subject to discussions within the ITU-T, who have requested an indication of the long term strategic direction for numbering for those countries who remain in the "7" range.

Whether the ITU would ever again agree to the allocation of a one digit code for a unified numbering scheme remains questionable. The promotion of political union is not a primary function of a numbering scheme.

6 European numbering options

Six options are considered using either national or world numbering resources.

6.1 The use of numbering resources

In order to promote the use of pan-European services, a ubiquitous approach is seen as a key requirement. Before starting to consider the options it is worth re-iterating some of the points made in other subclauses of this report which are particularly pertinent. The benefits of adopting this strategy must be weighed against the impact of change on both customers and networks. Changes cannot be introduced without cost penalties and whether these are customer, CPE or Network based, either directly or indirectly the users will pay. It also has to be assessed not only in terms of the intra-European scene, but taking account of the bigger picture, with Europe taking its rightful place as a key player in the changing global telecommunications environment.

The European traveller has long been aware of the demands and difficulties that are caused by the lack of a standard approach. An easy example of this is when arriving in another European country a traveller is currently unable to call home without knowing the international dialling prefix of the country visited. This problem has of course been recognised and is being resolved with the introduction of "00", the ITU-T recommended international dialling prefix, as a standard across Europe. The opening up of pan-European services will pose similar problems and is likely to be inhibited unless similar situations are avoided. The

⁸⁾ Council Directive 90/387/EEC [1]; Council Directive 90/388/EEC [2]; and Council Resolution 92/C 318/02 [5]

same problems also exist when global services are considered and studies in the ITU are currently addressing this. As previously referred to this adds another dimension which has to be taken into account as European issues can no longer be considered in isolation. Robustness and longevity of the resulting numbering scheme are also key criteria.

Where global schemes are a consideration clear migration paths from existing schemes should be identified. This remains a goal although it is recognized that for some services this may be impracticable. In this context the demands that Europe has to face are much more complex than those of North America. Trying to establish an acceptable migration from a national to a regional and then finally to a global scheme, is an order of magnitude greater than the one step, regional to global transition of North America. Unfortunately the status quo cannot be ignored.

Access to pan-European services could be gained through a number of methods, using both national and world numbering resources. An assessment of possible scenarios under each of these headings is now given with the perceived benefits and drawbacks of each approach being discussed and then listed in tabular form as a top level guide (see Clause 7). Other key issues are also highlighted in this manner. It should be appreciated that some of the alternatives impact not only on those who are directly involved but also on other networks which require access to the participants. Where that occurs due reference is made.

No reference is made to possible limitations imposed prior to time "T"⁹⁾ as it is the view of ETSI that it will not prove possible to introduce pan-European numbering space prior to time "T" due to external influences (such as ITU-T code allocation procedures).

6.2 Using national numbering resources

The following possible options have been identified using national numbering resources:

- a) continue with the present arrangements (option 1);
- b) harmonising national schemes for Europe wide services (option 2);
- c) dedicating common access codes for Europe wide services (option 3).

The use of national numbering resources would not require any action from the ITU-T.

Each option is considered in more detail in subclauses 6.2.1 to 6.2.3.

6.2.1 Continue with the present arrangements

Maintaining the status quo where in general there is little or no specific correlation across Europe will perpetuate the inconsistencies of the present differing approaches. No change is always viewed as an easy option and in some cases avoids the issue. However, in the case of numbering, any change, particularly where access to existing services or well established procedures are concerned, should not be taken lightly.

When considering pan-European services it is possible to view the situation in a slightly different light as some benefits would undoubtedly accrue from the introduction of a co-ordinated approach. Historically, national numbering schemes have developed independently, sometimes with minimum adherence to international standards due to technical constraints and network topology. This has resulted in a variety of differing prefixes, dialling formats and number lengths. Looking towards the emergence of pan-European non-geographic services, currently there is little correlation between the codes used for services of this type within national numbering ranges. This poses its own problems as even with a move towards conformity many users would have to re-adjust by learning the new codes and alter well established dialling procedures which have become "second nature". On a positive note, if this option was supported as well as making no new demands on users, networks would not require enhancement costs.

Number portability is frequently promoted as a key requirement in the competitive environment. However across Europe it would prove difficult to implement without a fully interconnected European IN network. Such a requirement will not be realised in the immediate future.

9) Time "T" is the date at which all international networks are required to be able to handle 15 digit international significant numbers (instead of the existing 12 digits) and is timed for 23.59.59p.m. coordinated time on 31 December 1996 (see CCITT Recommendation E.165 [7]).

6.2.2 Harmonising National Schemes for Europe wide services

This scenario requires harmonisation within existing national numbering schemes in order to access pan-European services on a common basis e.g. the common allocation of NDC fields (non-geographic) within each country. Commonality would of course only be required for access to new pan-European services, with existing national implementations remaining a national matter.

Past studies have all identified the limited scope to achieve this goal without major upheaval and network changes which would impact unduly on customers, network operators and service providers. Looking at the measure of commonality required coupled with the existing degree of diversity, the cost of change would also be very high and impact on all, whilst initial benefits would only be realised by those using the pan-European services. In some key areas following studies by CEPT (in its former guise as the standards co-ordination body prior to the formation of ETSI) a degree of standardisation has been agreed¹⁰⁾, with the introduction of standard EAC "112" for access to emergency services and, as referred to in subclause 5.1, the introduction of the standard international prefix "00". However this has not been achieved without difficulty as explained in subclause 6.2.3.

When harmonisation of national schemes is considered attention must also be given to dialling plan issues. In particular it should be noted that some European countries do not use a national prefix at all.

Implementation of this scenario could be merged with planned national changes.

The prime requirements of any scheme which aims to provide access to pan-European services must be that it is dynamic, able to provide the required degree of flexibility and does not result in lengthy implementation schedules, similar to those set for the introduction of "00" and "112". Achieving this through harmonising national schemes, with all its inherent problems appears difficult if not impossible. Any change to existing numbering schemes is always viewed as undesirable by users as their view of any benefits is normally diminished by the burden of changes that affect well established thought processes and practices. Many European countries have recently completed, or are planning major changes to their existing national numbering schemes which in some cases will result in a number of staged changes. Also, additional demands resulting from time "T" requirements and the emergence of global services at an ever increasing rate also have to be taken into account. The introduction of global services on top of regional and national offerings would also increase user perception difficulties as many of the service offerings would be similar e.g. global premium rate and Freephone services and European premium rate and Freephone services, whilst the access mechanisms may be totally different.

As previously stated national numbering schemes have historically developed in a totally disparate manner, with little conformity of structure in either number length, format or code allocation for services. The resulting problems also impact on this scenario. In a small number of cases the problem is not so acute, such as Freephone where a number national implementations use the code "800". However the main drive in this area is for a global service, not regional. Implementing a regional variation that fits between national and global schemes in a hierarchical manner places additional burdens on users by requiring them to differentiate down to that level. The potential for confusion with a three tier system may undermine the benefits being sought by service providers.

6.2.3 Dedicating common access codes for Europe wide services

This scenario utilises a set of common dedicated access codes across all European countries to access to pan-European services. As referred to in subclause 6.2.2 standardisation of access codes "112" and "00" has been agreed although implementation has taken a considerable period of time. Agreement on the choice of code was reached in CEPT in 1976 and the CEC issued a mandate for the introduction of common code "112" in 1991¹¹⁾, but full implementation has still not been achieved although the 1996 deadline is drawing near. It was an essential condition that countries could run the Emergency Service access code "112" in parallel with their existing national arrangement for the foreseeable future. It is anticipated that it will take at least a generation gap before users would automatically remember to dial the new code in times of stress or panic, where a fast connection is important. The same CEPT Recommendation in 1976 promoted the adoption of the "00" international prefix but full conformance in this case will not be achieved before 1998.

10) CEPT document "CEPT T/SF1" refers.
11) Council Decision 91/396/EEC [3] refers.

The option of accessing international operator services using code "115" and national directory enquiries using code "118" was also identified by CEPT and considered by the CEU. Currently there are no plans to advance these proposals as it has been generally recognised that the cost of change is greater than the perceived benefits. Having one common access code for directory enquiries may also be considered anti-competitive as it restricts the ability of operators to offer a better or cheaper service.

From the examples above it can be seen that the harmonisation of access codes is not an easy option. It is likely to require lengthy time scales for implementation and result in a piecemeal approach across European states.

Implementation of this scenario could be merged with planned national changes.

6.3 Using world numbering resources

The following possible options have been identified using world numbering resources:

- a) access using one or more CCs in addition to the existing codes (option 4);
- b) migrating to 3 digit CCs for all European countries (option 5);
- c) moving to a fully integrated numbering plan (option 6).

The realisation of any regional implementation using world numbering resources remains dependent upon ITU-T agreement on the allocation or re-use of CCs for that purpose. The effect of this is that it is not possible to introduce regional implementations quicker than global scenarios, both being dependent upon the same allocation procedures and time scales established within the Telecommunications Standardization Bureau (TSB).

Many of the other perceived benefits are based around a political agenda such as providing a political numbering identity for Europe, and breaking the mould of national number space within the community. This matter has already been discussed in subclause 5.1 e).

Each option is considered in more detail in subclauses 6.3.1 to 6.3.3.

6.3.1 Using one or more CC(s) in addition to existing arrangements

This option requires the ITU-T to allocate one or more CC(s) specifically for accessing new pan-European services. The allocation of these codes would be in addition to the existing CCITT Recommendation E.164 [6] CCs allocated to each European nation.

ITU-T agreement to such a request cannot be taken for granted. It is likely to be viewed as setting a precedent for future use, where until now each integrated numbering scheme has had to accommodate such demands within its existing capacity without having dual allocation of CCs.

There are a number of positive benefits to this proposal, the degree of change is minimal and direct cost on both network operators and users is relatively small. For new services which may not be offered on a national basis, problems related to the generation of false traffic due to mis-dialling are also minimal, but where services are offered at both the national and regional level customers would need to be made fully aware of the differences to minimise the risk. Where a service is offered on a national, regional and global basis these problems are of course even more acute.

It is also of benefit that from day one, users accessing pan-European services all dial exactly the same number no matter where they are in the community. Although again this advantage will be diluted with the introduction or overlay of similar service offerings on a global basis, especially for those who elect to take both.

This scheme could also provide a common structure for these services in terms of number format, where currently there are many variances across the community following the CC element. Other main advantages include the ability to introduce the change without major network or customer upheaval, and administration would also be simpler than some other alternatives.

Evolution will however be difficult from a potential regional numbering plan for pan-European services to a global numbering scheme for the same services without disadvantaging some subscribers and users. It

will cause inconvenience by requiring either a complete number change during the evolution process or acceptance of a longer international number than those outside of the pan-European scheme. This can only be avoided by generating a pan-European scheme with limitations on both the length and structure.

In principle, there are two forms of number structures applicable to global services. These are shown below, using the standard CCITT Recommendation E.164 [6] format (CC+NDC+SN) as alternative 1 (similar to that proposed for UPT) and alternative 2 (similar to that proposed for UIFS).

Alternative 1: $\boxed{\text{CC(UPT)}} + \boxed{\text{NDC(CC)}} + \boxed{\text{SN(NSN)}}$
CC(UPT): Country Code used as UPT service code.
NDC(CC): National Destination Code as country identification.
SN(NSN): National (Significant) Number.

Alternative 2: $\boxed{\text{CC(UIFS)}} + \boxed{\text{SN}}$
CC(UIFS): Country Code used as UIFS service code.
SN: Global Subscriber Number.

A pan-European numbering plan structured in a similar way would take the following form:

Alternative 3: $\boxed{\text{CC(UPTe)}} + \boxed{\text{NDCe}} + \boxed{\text{SN1e}}$
(based on alternative 1)
CC(UPTe): Country Code used as pan-European UPT service code.
NDCe: National Destination Code as country/region identification within Europe.
SN1e: Subscriber Number for a country/region in Europe.

Alternative 4: $\boxed{\text{CC(UIFSe)}} + \boxed{\text{SN2e}}$ _____
(based on alternative 2)
CC(UIFSe): Country Code used as pan-European UIFS service code.
SN2e: European SN.

It will never be possible to evolve from either of the pan-European alternatives to the global scheme shown in alternative 2, without a complete change of number for every subscriber to the service.

Evolution is possible from alternative 3 and alternative 4 to alternative 1, provided that the following sequence is followed:

From alternative 3 to alternative 1: $\text{CC(UPTe)} \rightarrow \text{NDC(CC)}$ and $\text{NDCe} + \text{SN1e} \rightarrow \text{SN(NSN)}$.

From alternative 4 to alternative 1: $\text{CC(UIFSe)} \rightarrow \text{NDC(CC)}$ and $\text{SN2e} \rightarrow \text{SN(NSN)}$.

The last evolution from alternative 4 to alternative 1 would always create a global number for the pan-European services that are longer than the global numbers for the same service outside Europe, i.e.:

- $\text{CC(UIFSe)} + \text{NDC(CC)} + \text{SN(NSN)} > \text{CC(UIFS)} + \text{SN}$.

This is because the evolution needs to take account of the fact that the European number contains both a European and country geographical identities, while the global number is a pure location and service provider independent number. The result is: **global services in Europe would be shorter.**

6.3.2 Migrating to 3 digit CCs for all European countries

This option calls for all European countries to change to three digit CCs behind a common first digit. Most European countries had either a two digit code beginning with the digits "3" or "4", or a three digit code beginning with "3", although there are a few exceptions¹²⁾. A list of current European CCs is given in Annex A. Implementation of this proposal would effectively sterilise all codes behind the selected initial digit, other than for use within Europe. This would require ITU-T agreement. Recently ITU-T SG 2 agreed to drop the principle of allocating CCs in world "zones". As a first step an ITU-T bulletin was issued showing the codes allocated in numerical order with no reference to the previous zone structure. Adoption of this proposal contravenes that decision.

The proposal is that all European CCs should become three digit codes behind the initial digit "3". With this option the impact of change is very high for both network operators and users. It also impacts on all countries around the world. Although this change cannot be introduced without the full co-operation of the rest of the world, outside of Europe there is no benefit to be gained from such a change other than the potential return of the number space behind the initial digit "4". As referred to later, from a European perspective giving up the digit "4" range could in itself lead to capacity problems. With this option, the total numbering capacity of Europe is reduced anyway. Furthermore, this numbering capacity is not shared between European countries according to their respective sizes.

Such a change could be accomplished in a number of ways, although there is no scenario that does not have its own particular degree of difficulty. To understand the issues there is a need to look at some possible examples in more detail.

Existing European CCs, formerly in world numbering zones 3 and 4, have the following structure:

3X where X = 0,1,2,3,4,6,9.
3XY where X = 5,7,8
 and Y = 0 through 9¹³⁾.
4Y where Y = 0 through 9.

as well as changing existing "3X" codes to three digit codes, all the current "4Y" codes have to be moved into the "3XY" range. Irrespective of what scenario is considered the changes are complex and would also demand parallel running between the old and new schemes for a period of time, as the ability to trap misdialled calls is a key requirement. As will be shown in the following examples, this cannot be achieved.

¹²⁾ For example: Russia, Turkey, Faroe Islands, Greenland.

¹³⁾ Codes 374, 375, 380, 382, 383, 384, 388 are not assigned.

As a minimum, the changes would need to be progressed in two separate stages. The following two scenarios are possible examples.

Scenario 1: Insert the initial digit "3" in front of all existing two digit codes.

Stage 1 - both France (existing CC "33") and Spain (existing CC "34") have to change to CC's "333" and "334" respectively in order to free the numbering space for the other countries to move into. Parallel running cannot be implemented by either France or Spain in this instance.

Stage 2 - all remaining countries with two digit CC's change to three digit codes by inserting the initial digit "3" in front of their existing codes.

When CCs are changed all international gateway switches which require access have to be modified. On top of this a global customer awareness programme has to be set in place. A prime requisite of any successful number change is the ability to trap calls. For a change of this magnitude it is considered a must. With this scenario only limited call trapping mechanisms can be set in place. At stage 1, calls destined for France which are mis-dialled using the old code "33" followed by any French NDC beginning with "4" will route to Spain. No call trapping is possible to counter this. The situation is even more serious at stage 2, where any mis-dialled calls to France or Spain using the old CC's will route to a number of other countries depending upon the next digit dialled.

Scenario 2: Insert digit "0" behind all existing two digit codes beginning with "3", then change existing two digit codes beginning with "4".

Stage 1 - all 3X codes are changed to 3X0 where X = 0,1,2,3,4,6,9
Code "40" would also need to be replaced with a spare 3XY code

Stage 2 - all 4Y codes are changed to 34Y for Y=1 through 9

A similar set of problems occur with this scenario. Before the change the CC for Germany was "49", Norway "47" and the UK "44". Germany's code will change to "349", Norway to "347" and the UK to "344". Previously Spain's CC changed from "34" to "340". Users across the globe who still dial customers in Spain using the old Spanish CC, wanting Spanish numbers beginning with the initial NDC digits of "9", "7" or "4" will be routed to Germany, Norway or the UK respectively.

This situation is made more acute when language difficulties are taken into account e.g. a caller dialling Spain from South America may speak Spanish but not German, Norwegian or English.

The scale of this problem should not be underestimated. International numbers are advertised across the globe in a variety of ways, some of which may never be amended but will still perpetuate the use of the old number. As well as this some users will only make international calls irregularly, but may have a mental picture of what to dial etched in their mind over a period of time. No matter how much a change is publicised, mis-dialled calls will occur for a long period of time following the change. For a change of this nature it is advocated that where call trapping mechanisms can be used they are left in place for a minimum of one year, but ideally for at least two. For Europe this impacts on the time required to make the proposed changes. If the main driver is the need for pan-European numbering space, a number of global services could be launched in the mean time, which will embody regional aspects and reduce the need. If the driver is political unity behind the digit "3" then expecting the rest of the world to accommodate changes of this magnitude, which will not be without cost for little benefit to them, is difficult to justify.

Difficulties may also increase if countries outside of the previously recognised European numbering zone, such as former USSR states, demand "3XY" codes from the ITU. Questions also remain unanswered over the former world zone "2" countries of Greenland and the Faroe Islands. Although it would be possible to incorporate them into the proposed scheme.

With scenario 2 above questions are also raised over the ability of some European countries to change to "3X0" codes as the digit "0" is used within some national numbering schemes.

It is not envisaged that the dialling procedures within Europe will be changed.

This scheme could enable all CCs beginning with the initial digit 3 being allocated to Europe but this would require ITU-T concurrence. Capacity problems could still occur as the liberalised market gains momentum. For instance, in the UK a number of operators now provide service. Future changes could see a requirement for different codes being allocated to each e.g. separate codes for BT, Mercury, Energis, AT&T, etc. which rapidly increases the demand on the numbering space. With the liberalisation of European markets such a demand could gain momentum. Returning the initial digit "4" to the ITU limits flexibility that may later be required.

Although realistically changes are unlikely to occur before time "T" this proposal still means that countries moving from a two to a three digit code, have the capacity of their available number space reduced from what they envisaged when they agreed to the maximum international number length of 15 digits.

In terms of management with all European codes behind an initial digit this number space could be managed by a European numbering office, such as that set up under the ETO referred to in subclause 5.1 e), with national numbers remaining under the control of the national regulatory authorities. As mentioned in subclause 5.1 e) the required degree of regulatory steer over European numbering strategy may also be achieved by ECTRA influencing national regulation.

6.3.3 Moving to a fully integrated numbering plan

This option calls for the introduction of a fully integrated numbering plan to embody the numbering requirements of all European countries behind a one digit CC. It follows the example of North America who currently utilise the initial CC digit "1". This scheme is viewed as the most radical and far reaching proposal. The establishment of such a scheme would demand major changes affecting all parties involved and require a comprehensive and ongoing customer education process.

It would facilitate a clear European numbering identity. Existing European CCs would be withdrawn and countries could be identified with NDC allocations. One impact of this is, that like the previous scenario, European countries with existing two digit CC's again have their numbering space reduced. This would, of course, reduce the total numbering space of Europe.

The main benefit of this scheme is that in the longer term all customers within Europe will have the ability to dial the same numbers for all calls within Europe no matter where they are within the continent. The need to dial the international prefix for these calls disappears, although as described in 6.2.3 many of the difficulties that currently surround the use of the prefix disappear by 1998 when all of Europe would have adopted "00" as the standard.

Similar to that described in 6.3.2 it also enables European management of the scheme behind the initial digit, although the points made subclauses 6.2.2 and 5.1 e) still apply. It also has the potential for harmonizing carrier selection within Europe.

To achieve the degree of harmonization which is voiced whenever this scheme is promoted would require extensive re-engineering of national numbering schemes, extensive and on-going customer awareness programmes and incur costs of a high magnitude. The change to all European CCs would need to be made by all network operators. Changes to a vast number of European subscribers numbers would also result. For customers, changes to their CPE, advertising, stationary etc. would also incur high cost. For some countries these changes would follow one or more expensive changes which have recently occurred within their national schemes.

This proposal can only be viewed as a long term goal. ETSI do not believe that a change of this magnitude could take place in the short term without damaging Europe's ability to compete on a global basis. The next decade will see rapid changes in technology, the introduction of a whole variety of existing and new services on a global level and the emergence of new markets. Introducing expensive major changes at the national level to facilitate regional demands is likely to impact unduly on European operators ability to compete in an extremely competitive and aggressive world market. It must also be recognised that the growth of global services will not falter without European participation, which again raises questions over the push for regional variants. On this point it is appropriate to draw attention to the European users views referred to in subclause 5.1.

Again the political dimension comes to the fore, but to undertake a programme of change, the scale of which has never been contemplated before in terms of world numbering, without being able to provide tangible benefits which are indisputable cannot be supported at this time.

7 Assessment of options

A top level assessment of each of the options considered is provided in tables 1 and 2.

Table 1: Assessment of options 1 to 3 - using national numbering resources

National numbering resource		National numbering resource		National numbering resource	
Option 1: continue with present arrangement		Option 2: harmonising national schemes		Option 3: dedicated common access codes	
For	Against	For	Against	For	Against
- zero costs;	- inconsistent approach.	- implementation could be merged with planned national changes;	- high cost for some countries that require major changes;	- implementation could be merged with planned national changes;	- limited availability of codes;
- does not require ITU-T action.		- does not require ITU-T action.	- major impact on users;	- does not require ITU-T action.	- long time scales for implementation;
			- major impact on networks, service providers and users;		- piecemeal approach.
			- limited flexibility;		
			- would compound difficulties from recent/planned national changes.		

Table 2: Assessment of options 4 to 6 - using world numbering resources

World numbering resource		World numbering resource		World numbering resource	
Option 4: Using additional CCs		Option 5: Migrating to 3 digit CCs		Option 6: Fully integrated numbering plan	
For	Against	For	Against	For	Against
<ul style="list-style-type: none"> - relatively small direct costs; - minimal impact on network operators, service providers & users; - standard number formats for new services in Europe; - quicker to implement than options 5 & 6; - maintains familiar dialling formats. 	<ul style="list-style-type: none"> - limited European numbering identity (note); - goes against recent ITU-T allocation principles; - difficult evolution from pan-European to global solutions; 	<ul style="list-style-type: none"> - European identity in initial digit (note); - maintains familiar dialling formats. 	<ul style="list-style-type: none"> - high costs; - high impact on network operators, service providers & users; - long implementation time scales; - mis-dialling problems; - limited call trapping; - same numbering space per country irrespective of country size; - would reduce the total numbering capacity of Europe. 	<ul style="list-style-type: none"> - clear European identity in the number (note); - easy introduction of new services when scheme established; - ease of dialling within Europe in the longer term. 	<ul style="list-style-type: none"> - extremely high costs; - high impact on network operators, service providers & users; - long implementation time scales; - may impede operators global marketing ability; - goes against recent ITU-T allocation principles; - does not maintain familiar dialling formats; - would reduce the total numbering capacity of Europe.
<p>NOTE: It remains unclear what actually would constitute a European identity.</p>					

8 Conclusion

There is clearly a need to support pan-European services. Using national numbering resources to introduce this requirement is unacceptable. It could not provide either the flexibility or capacity required. Therefore the use of world numbering resources is recommended.

Even with this approach, difficulties will occur. It is the view of ETSI that the schemes considered in subclause 6.3.2 (Migrating to 3-digit European CCs) and subclause 6.3.3 (Moving to a fully integrated numbering plan), will prove difficult to implement, incur high costs, and implementation time scales will be long. This would not facilitate the rapid introduction of these services in order to meet the demand.

Methods of introducing pan-European services must be assessed on a cost basis. If a European identity is the prime requirement this should be explicitly stated.

On a cost benefit basis, European requirements can be realized within global schemes.

It should also be realized that regional schemes cannot be introduced more quickly than global schemes.

Europe must be pro-active in the establishment of global solutions within the ITU-T to ensure that their requirements can be realized. ETSI welcomes the creation of the ENF which should facilitate a strong unified approach being taken into the world numbering fora discussion.

ETSI wishes to state its commitment to work towards these goals for the benefit of Europe and looks forward to close co-operation with all parties involved.

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