

FINAL REPORT
ON
REVIEW OF
NATIONAL NUMBERING SCHEMES
ON THEIR OPENNESS TO COMPETITION



15 October 1997

This study has been prepared by ETO on behalf of ECTRA for the Commission of the European Union.

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1. EXECUTIVE SUMMARY

This study on the "Review of national numbering schemes on their openness to competition" is one of the ETO studies prepared for the European Commission on behalf of ECTRA. Its purpose is to make proposals which facilitate the liberalisation of the telecommunications market in 1998. The report addresses three different issues: 1) to assess national numbering schemes of 18 European countries with regard to attributes defined for numbering schemes in competitive environment, 2) to provide basic guidelines in developing national numbering schemes and 3) to study the convergence of numbering schemes of European countries. The main focus of this study are the first two issues. The issue of convergence is discussed as a long term goal and an example of one of the possible means is given.

In the study, four groups of attributes are defined for numbering schemes in a competitive environment. These groups are: 1) numbering capacity, 2) non-discriminatory access to numbering resources, 3) user-friendly dialling and 4) the possibility for European harmonisation. The numbering schemes of 18 European countries were assessed from the perspective of these attributes. Fourteen of these countries were EU countries and four non-EU countries. The results of the analysis showed that three groups of countries can be distinguished:

- 1) In Finland, Denmark, Sweden and the UK, where competition has already been introduced, national numbering schemes seem to facilitate competition. Only some temporary capacity problems exist, but these problems have been identified and numbering schemes are currently under revision.
- 2) Among countries introducing competition in 1997/1998, France, Germany, the Netherlands and Norway seem to have schemes that facilitate competition. Of the others, Belgium seems to have problems with capacity, Austria and Switzerland with non-discriminatory access and Italy and Spain with both capacity and non-discriminatory access.
- 3) Greece, Hungary, Ireland, Portugal and Slovak Republic, which are introducing competition after 1998, seem to have problems with capacity and/or non-discriminatory access.

Based on the country analysis, this report gives basic guidelines for developing national numbering schemes. These guidelines include criteria for assessing limitations in the numbering capacity and propose minimum measures and actions that need to be taken in order to prepare schemes that are appropriate in a competitive environment. ETO proposes the free capacity of geographic numbers be extend at least to three usable numbers per person, free capacity of non-geographical numbers at least to five numbers per person. Furthermore, a resource of at least 100 three digit codes should be made available for short codes. For non-discriminatory access to numbering resources ETO proposes that numbering should be planned and administrated by NRA, numbering plan itself and rules for allocation should be developed and published in a transparent way and NRAs should consult a representative body on all key policy issues of numbering. These guidelines will be further elaborated in the ongoing ETO studies on "Harmonised National Numbering Conventions" and on "Harmonisation of Short Codes in Europe" which are due by the end of 1997.

With regard to the convergence of numbering schemes of European countries, such convergence is an issue related to European numbering strategy. A study on the European numbering strategy is being prepared by ETO and it will be finalised in 1997. However, while studying numbering schemes of European countries, it was noted that some common denominators already exist in national schemes. Some of these denominators are even looked for by NRAs when preparing their new numbering schemes. Taking into account this natural and voluntary development of national schemes, ETO has also prepared the example of a model scheme by which natural convergence of European schemes could take place. This example should be discussed by the industry and considered as an input to the study of the European numbering strategy.

In this model scheme, the first dialled digit 0 or two first digits 00 are proposed for use as trunk and international prefixes respectively, and digit 1 for the addressing of different services, short codes

and prefixes, national or European. In the numbering plan, N(S)N number ranges 6 and 7 are proposed to be used for mobile and personal communications services, and number ranges X0, and particularly X00 (X=1-9), are proposed to be reserved for the numbering of commonly recognised national services, such as freephone and shared revenue services.

2. PRESENTATION OF THE STUDY

This study on the “Review of National Numbering Schemes on their Openness to Competition” has been prepared by ETO on behalf of ECTRA for the European Commission. In view of the liberalisation of the telecommunications market in 1998, the openness of national numbering schemes is seen as the key to effective competition. Common guidelines are needed by NRAs when revising their national numbering schemes. The text of the work order is attached in Annex 1 and the abbreviations used in Annex 2.

The work assigned to ETO is as follows:

1. To assess which aspects are of importance when considering the openness of national numbering schemes to competition (e.g. empty ranges for prefixes for carrier selection, equal quality of numbers for service branding by competing operators, service providers)
2. To review national numbering schemes and assess their openness to competition
3. To develop criteria for the structure of open and user-friendly numbering schemes, taking into account their openness to competition and the convergence aim of the schemes
4. To develop common guidelines for Administrations when revising their national numbering schemes

The study has been carried out by ETO in close co-operation with the ECTRA Project Team on Numbering and the parties represented in the European Numbering Forum (ENF)¹. ETO commissioned part of the study to the UK based consulting company Ovum Ltd, which carried out a country analysis and assessed the present European numbering schemes against the attributes defined for numbering schemes of competitive environment.

The country analysis carried out by Ovum was discussed in a separate workshop in November 1996. The combined draft first and second interim report, containing Ovum’s analysis and draft ETO proposals was discussed at the ECTRA PTN meeting in February 1997. After PTN’s comments the report was sent to ENF members for their comments, which were discussed at the PTN meeting in the end of April 1997.

The draft final report was distributed to ECTRA and ENF in order to obtain their comments. Comments were received from Finland, Germany, the Netherlands, Poland, Portugal and from ECTEL and ETNO. Most of the comments are incorporated in the final report. However, ETNO opposes some of the recommendations. ETNO comments are attached to the final report. The final report to be sent to the European Commission will contain findings and proposals, as approved by CEPT/ECTRA, and will include the comments individual CEPT/ECTRA members have made on these issues in relation to their respective national regimes.

¹ The European Numbering Forum (ENF) was established as a Forum for the exchange of information and expertise, co-ordination and consultation, discussion and common studies on European numbering, addressing and other related issues, in accordance with European Union Council Resolution 92/C318/02 on the promotion of co-operation on numbering of telecommunication services throughout Europe. Currently participating in the ENF are the following European organisations (in alphabetical order): the CEC (Commission of the European Communities), ECMA (Standardizing Information and Communication Systems), ECTEL (The European Telecommunications and Professional Electronics Industry), ECTRA (European Committee on Telecommunications Regulatory Affairs), EIIA (European Information Industry Association), ETNO (European Public Telecommunications Network Operators’ Association), ETSI (European Telecommunications Standards Institute), GSM MoU EIG (GSM MoU European Interest Group) and INTUG Europe (International Telecommunications Users Group).

3. INTRODUCTION

From 1st January 1998, most of the EU countries are committed to permitting competition in the whole telecommunications sector and, in particular, in public voice telephony over fixed networks. The move to competition entails the need to review the national numbering schemes to ensure that they will support effective competition.

European countries which have introduced competition in networks and services, have already changed their numbering schemes in order to guarantee adequate resources to facilitate competition. Some countries have carried out fundamental changes recently (Finland, France, Norway, the UK), and some countries are planning to do so. Some countries have carried out minor changes in order to respond to the most urgent numbering requirements in the short term but are planning more fundamental changes in the future. Numbering plans are being reviewed in most European countries.

In this report, the present numbering schemes of 18 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland and United Kingdom) are studied with regard to their openness to competition. These countries include 14 EU countries and four non-EU countries. Based on this country analysis, this report provides some general measures for NRAs to assess the openness of their national numbering schemes to competition and to assess the sufficient availability of current numbering resources in a competitive environment. This report should assist NRAs in initiating necessary actions needed for changing their numbering schemes and give basic guidelines for developing their schemes.

In the Green Paper on Numbering Policy, the European Commission proposes actions to be taken for ensuring the convergence of national numbering plans including the harmonisation of specific access codes. Convergence of national numbering schemes, as well as harmonisation of some commonly used short numbers or access codes, may facilitate user-friendly use of telecommunications services within the European market area. Present numbering plans of European countries are inconsistent with each other and have been planned in isolation.

This study proposes a common model for a "European" numbering scheme, to be considered by countries which are planning fundamental changes in their numbering schemes. This model provides a resource for European harmonisation. If these guidelines are followed, numbering schemes of European countries would gradually converge and would facilitate user-friendly means in using telecommunications services in the European market area in the long run. Guidelines given today can only be based on current demands. Future demands can be taken into account only by reserving spare capacity which can be activated according to new guidelines. Taking into account the fast evolution of the telecommunications sector, these guidelines may need to be reviewed and amended from time to time.

4. ATTRIBUTES FOR NUMBERING SCHEMES IN A COMPETITIVE ENVIRONMENT

In order to assess numbering schemes on their openness to competition, criteria have to be established which define requirements for numbering schemes in a competitive environment. ETO held a brain-storm meeting with members of ECTRA PTN, ENF, the CEU and with participants from a number of interested parties representing the telecommunications industry. The purpose of the meeting was to collect views on issues which facilitate competition in telecommunications networks and services. This meeting agreed upon a list of attributes (Annex 3) in accordance with item 1 of the work order. These attributes were divided into the following four groups:

- **Numbering capacity**
Numbering schemes should have enough capacity to number present and future services and subscribers, capacity for geographic and non-geographic numbers including personal numbers, capacity for carrier access codes and short numbers and service access codes for commercial and non-commercial services.
- **Non-discriminatory access**
Numbering should be administered by an independent body, reciprocity and symmetry between network operators and between service providers should not be constrained on numbering grounds, numbering schemes should guarantee the same dialling procedure for all corresponding network operators and service providers, numbering should be transparent, schemes should allow all applicants a non-discriminatory access to numbering resources.
- **User-friendliness**
Numbering schemes should be stable and they should be capable of accommodating customers who want to change their network operator or service provider without changing their telephone number.
- **Harmonisation**
Numbering schemes should allow for migration from national service numbers to pan-European and/or global service numbers and they should allow for the harmonisation of service access codes, carrier selection prefixes and possibly PCS numbering at a European level.

In this study these attributes are used 1) to analyse the present numbering schemes of European countries on their openness to competition and 2) to prepare guidelines to be considered by NRAs when carrying out changes in their numbering schemes.

5. COUNTRY ANALYSIS

ETO subcontracted the UK based consultancy company OVUM to study the compliance of national numbering schemes of 21 CEPT countries (15 EU countries and six non-EU countries) with the attributes defined earlier. The analysis was based on the questionnaire sent to countries. 18 countries responded and were analysed in more detail (14 EU countries and four non-EU countries). The purpose of this analysis was three-fold:

- it should assess the present numbering schemes in European countries with regard to their openness to competition,
- it should provide lessons learned from countries where competition has been introduced - advantages and disadvantages of the applied numbering schemes - and
- based on the results of the analysis, it should find applicable guidelines for developing numbering schemes for a competitive environment.

This country analysis covers item 2 of the work order. It was carried out by written questionnaire in which the measures used in the analysis were based on the following questions:

Numbering capacity

- what is the current usable geographical numbering space?
- what is the available numbering space for non-geographical services?
- what is the number of available three digit short codes within the dialling plan? ²
- what is the number of free two digit NDCs ³?
- how easy is it to change the plan to create extra capacity?

Non-discriminatory access

- Does the national numbering scheme and its administrator offer competing operators non-discriminatory access to numbering resources?
- Does the numbering scheme offer operators non-discriminatory access to geographic numbering capacity?
- Does the numbering scheme offer operators non-discriminatory access to non-geographical numbering capacity?
- To what extent do new entrants have non-discriminatory access with the incumbent to carrier selection codes?

User-friendliness

- Does the dialling plan offer user-friendly dialling procedures?
- Does the dialling plan convey information to the caller?
- How stable are numbers and how stable will they remain?

Harmonisation

- To what extent has each country already adopted proposals for harmonised use of trunk and international prefixes and for harmonised codes for emergency and directory enquiry services?
- What is the potential for future harmonised use of 10X and 11X codes?
- To what extent are the codes 700/878, 800 and 900 used for personal numbering, freephone and shared revenue services respectively?
- If these codes are not used now, how easy is it for a country to use them for these services in the future?

Results of the analysis with regard to capacity and non-discriminatory access as presented in table 1 are neither fully comprehensive nor totally reliable. However, the table gives some indication of

² The number of 3 digit short codes has been used to characterise the capacity for short codes.

³ In closed schemes the number of free 2 digit blocks in N(S)N.

the current situations in different countries. A more detailed analysis can be found in Annexes 4 and 5.

There are no final and objective criteria to assess user-friendliness and harmonisation. The criteria used and assessment made are based on subjective measures defined in Ovum's report to ETO. The result of this assessment can be found in Annexes 6 and 7. The description of national numbering schemes is in Annex 8.

	Capacity	Non-discriminatory access	Change under consideration
EU countries			
Austria	Adequate 1)	Not adequate 2)	s
Belgium	Not adequate	More or less 3)	s
Denmark	Adequate	More or less	
Finland	Adequate	More or less	
France	Adequate	More or less	
Germany	Adequate	More or less	
Greece	Not adequate	Not adequate	
Ireland	Adequate	Not adequate	s
Italy	Not adequate	Not adequate	s
Luxembourg			s
Netherlands	Adequate	More or less	
Portugal	Adequate	Not adequate	s
Spain	Not adequate	Not adequate	s
Sweden	Not adequate	More or less	s
UK	Adequate	More or less	s
Non-EU countries			
Hungary	Not adequate	Not adequate	s
Norway	Adequate	More or less	
Czech Republic	Adequate	Not adequate	s
Switzerland	Adequate	Not adequate	s

Remarks in the table:

- 1) Adequate: There is no exact definition of the term adequate capacity. In this study it means that the capacity criteria are mostly met and no significant capacity problems exist in the scheme.
- 2) Not adequate: Means that the criteria are not fully met and some actions need to be taken in order to comply with the criteria defined.
- 3) More or less: Means that the criteria of non-discriminatory access are met in principle. However, some actions may need to be taken with regard to, for example, number administration, transparency etc.
- Ni: No information. Revision of a numbering plan under consideration.

Table 1. Assessment of 18 European countries against the attributes of numbering schemes in a competitive environment

Several groups of countries can be distinguished:

1. In countries where competition has already been introduced (Denmark, Finland, Sweden and the UK), national numbering schemes seem to facilitate competition. Only Sweden has some capacity problems, but the Swedish numbering scheme is currently under revision.

2. Among countries which are introducing competition in 1997/1998 (Austria, France, Germany, Netherlands, Switzerland, Norway, Belgium, Italy and Spain),
 - a) France, Germany, Netherlands, and Norway seem to have schemes non-discriminatory enough for competition.
 - b) Belgium seems to have some capacity problems,
 - c) Austria and Switzerland seem to have problems with non-discriminatory access.
 - d) Italy and Spain seem to have problems with capacity and non-discriminatory access.
3. In countries which are introducing competition after 1998 (Greece, Ireland, Portugal, Hungary and the Slovak Republic), some problems with capacity and/or non-discriminatory access have been identified in the present schemes.

With regard to non-discriminatory access to numbering resources, two countries - Austria and Switzerland - plan to allocate separate NDCs for new entrants to number their geographical subscribers. Most numbering experts believe that such a procedure is both anticompetitive and is likely to lead to considerable user confusion, especially in countries with open numbering plans. These countries should, therefore, reconsider their schemes in accordance with the criteria of non-discriminatory access. Switzerland has decided to close the numbering scheme, although the date has not been published yet. Portugal is planning to close the scheme and take into account issues of non-discriminatory access to geographic numbers prior to the introduction of competition.

Conclusions:

1. In Italy and Spain, numbering schemes should be revised urgently in order to allow for competition in 1998.
2. When developing their numbering plans, Austria and Switzerland should consider the criterion of non-discriminatory access and should not allocate geographical NDC resources to competing operators.
3. In Belgium and Sweden attention should be paid to numbering capacity.
4. Greece, Ireland, Portugal, Hungary and the Slovak Republic should urgently start planning non-discriminatory numbering schemes in order to be prepared for competition after 1998.

6. BASIC GUIDELINES FOR DEVELOPING NATIONAL NUMBERING SCHEMES

In this chapter, guidelines for developing numbering schemes are given. These guidelines lay down simple criteria with which to assess when the capacity of the scheme is getting exhausted. They also provide some guidance about the minimum level to which capacity should be increased in order to facilitate non-discriminatory numbering. Furthermore, guidelines are given for implementing non-discriminatory access, user-friendly numbering and harmonisation.

Two types of numbering schemes – open and closed – are used in Europe. In open schemes, NDCs are used to denote geographic and non-geographic numbering areas or destination networks. Local dialling is possible. In a closed scheme, one country usually comprises one numbering area. Local dialling is not possible. Most of the European countries use open schemes with commonly defined NDCs. NDCs are - therefore - used in this study as one of the measures to assess number capacity. In closed schemes, where NDCs are not usually used, first digits of a National (Significant) Number (N(S)N) are used instead of NDCs to correspond with capacity measures.

These basic guidelines should help NRAs to make intermediate changes or minor adjustments to the present schemes. For more comprehensive, fundamental changes common guidelines including aspects of European harmonisation and convergence aim are given in chapter 7.

6.1 Basic guidelines on numbering capacity

The possibility of the running out of numbering capacity is, and should be, the main reason for making major changes to a numbering plan. While other objectives of non-discriminatory access to numbers, user friendliness and harmonisation are important, it is a fundamental duty of the NRA to ensure that the development of telecommunications is not constrained by lack of numbering resources.

There are at least four different measures of numbering capacity which need to be considered:

- capacity for numbering subscribers to geographic services
- capacity for numbering subscribers to non-geographic services
- free NDC capacity for new services
- capacity for short codes

Shortage in any one (or any combination) of these measures can lead to the exhaustion of numbering resources. So, in expanding overall numbering capacity, it is important to strike the right balance between the four measures. It is easy to produce massive increases in capacity in two of the measures at the expense of inadequate increases in the other two. Annex 9 (Scarcity of resources) provides further information on number capacity. In Annex 10 (Guidelines on number length) consideration is given to the length of geographical subscriber numbers.

There are no firm quantitative rules on when a numbering scheme is reaching exhaustion. The guidelines which are offered below for each of the four capacity measures are, necessarily, subjective and may be debatable. However, in order to find some general measures, which are easy to understand and comparable in all countries, ETO proposes the measures mentioned separately in each of the following sections.

6.1.1 Geographic numbering space

Capacity per person.

One measure to assess the capacity of geographical numbers is to calculate usable geographic space per person. A numbering scheme in which the usable geographic space (i.e. the numbering space allocated to geographic services multiplied by the maximum utilisation achievable) has fallen below **one number per person** is in danger of exhaustion. Countries which have reached this position should consider a review.

When carrying out a change to the numbering scheme it is sensible to increase geographic capacity to at least **three usable numbers per person**. It is tempting to assume that future growth in demand for geographic services will be weak (especially in countries with stable or shrinking line penetration). However, demand for DDI, for different ringing tone services and for ISDN can lead to significant growth in the number of numbers required per line, maybe up to 10 numbers per person.

Capacity of free SN blocks

Another measure for the capacity of geographical numbers - and perhaps the most important measure in a competitive environment - is the capacity of free SN blocks. In primary allocation, NRAs allocate subscriber number blocks to access network operators. The amount of free SN blocks is a key enabler to non-discriminatory access to SN resources. The size of a block may vary from 1000 numbers to one million numbers or even more, depending on the capacity need of the access network operator and the number length available. In order to define the free capacity of a SN resource, ETO uses as a reference the number of free three digit SN blocks. To define adequate capacity of free SN blocks, NRAs have to consider:

- Efficiency of already allocated blocks
- Possibility to port numbers
- Overall growth in number demand
- Need for allocation of subsequent number ranges to subscribers

National circumstances and numbering principles differ from each other and it may be difficult to give general rules for adequate block capacity. However, as a rule of thumb it may be considered that if the capacity of free three digit SN blocks has fallen **below 5%** of the total amount of blocks dedicated to SNs, the SN resource is in danger of exhaustion. In a non-discriminatory numbering scheme, the number of free blocks should be **at least 20%** of the total SN block capacity.

Guidelines on capacity for geographic numbers:

Capacity per person

5. A numbering scheme in which the usable geographic space has fallen below **one number per person** is in danger of exhaustion.
6. When carrying out changes to the numbering scheme, it is sensible to increase geographic capacity to at least **three usable numbers per person**.

Number of free SN blocks

7. As a rule of thumb, an SN scheme in which the number of free three digit SN blocks has fallen **below 5%** of the total amount of SN blocks is in danger of exhaustion.
8. When carrying out changes to the numbering scheme it is sensible to increase the capacity of free SN blocks **to at least 20%** of the total number of SN blocks.

6.1.2 Non-geographic numbering space

Capacity per person

Countries in which the numbering space available for non-geographic services is below **two numbers per person** should consider a major review. The level to which capacity should be increased is a matter of judgement. ETO suggests that any major change should make **at least five numbers per person** available for non-geographic services.

Capacity of free NDCs

Within the space available for non-geographic services it is important to keep NDCs free for the numbering of new and as yet unforeseen services. (This numbering space may, of course, be used eventually for numbering existing geographic and non-geographic services as well). To define measures for NDC resource, ETO uses a number of free NDCs⁴ defined by two digits. Countries with **five or fewer free two digit NDCs** in a numbering scheme should consider whether they need a major review. In designing the new plan, they should aim to create **20 or more free two digit NDCs**.

Guidelines on capacity for non-geographic numbers

Capacity per person

9. Countries in which the numbering space available for non-geographic services is **below two numbers per person** should consider a major review.
10. A major change should make **at least five numbers per person** available for non-geographic services.

Number of free NDCs

11. Countries with **five or fewer free two digit NDCs** in a numbering scheme should consider whether or not they need a major review.
12. In designing the new plan, they should aim to create **20 or more free two digit NDCs**.

6.1.3 Numbering space for short codes

The term short code is understood here to mean a code of a few digits in length that can be used e.g. for short numbers or access codes for different services. Adequate supply of short codes within the national dialling space is important. The introduction of competition in basic services creates new demands for short codes. Most countries in Europe allocate 10% or more of their dialling space to short codes (i.e. 100 or more three digit short codes are possible). Countries with significantly less space than this allocated to short codes may encounter problems. They may wish to review their numbering scheme (especially if it is nearing exhaustion in some of the other capacity measures). If they do not, then they will need to:

- ration the use of short codes very carefully, with strict rules on which services can use short codes rather than (say) freephone or shared costs subscriber numbers.
- use long carrier selection codes (five or six digits) and implement preselection as soon as possible in order to minimise user inconvenience.

⁴ In closed schemes the number of free 2 digit blocks in N(S)N

ETO proposes reserving ten per cent of the total dialling space for short codes (i.e. 100 or more three digit codes).

Guidelines on short code capacity:

13. A minimum of 10% (i.e. 100 three digits short codes) of the entire available numbering space should be reserved for short codes.

6.2 Strategies for expanding capacity

Users do not welcome major numbering changes. The disruption that they cause is costly. (According to some estimates, the full economic cost of a major change to a numbering plan can reach 50 ECUs for each person in the country). So it is important to keep the frequency of major changes to a minimum and to plan changes which will (hopefully) last for several decades.

There are a number of ways of making substantial increases in the capacity of a numbering scheme. NRAs can create substantial extra capacity

- by increasing numbering lengths (perhaps as part of the general review of the numbering scheme) or
- through a major reduction in the number of NDCs.

These alternatives are discussed in more detail in the following sections.

6.2.1 Adding a new leading digit to the existing plan

Adding a new **leading** digit to the existing numbers (and hence increasing the capacity of the plan ten fold) is the commonest strategy. To implement it, a numbering scheme must keep one of the initial digits of the plan free so as to trap misdials. In a plan where the initial digits of a number already convey information clearly such a strategy has a major disadvantage. It reduces the information conveyed to the caller. Conversely, in a plan where the initial digits currently convey little information such a strategy offers an opportunity to increase the information carried by the numbering scheme.

6.2.2 Inserting a new digit behind the first or second digit of the existing plan

Inserting a new digit behind the **first or second digit** of the existing plan is the most appropriate strategy where the initial digits of the existing plan already convey information to the caller. But it can only be implemented satisfactorily if one value of the second or third digit of the current plan is unused or can be cleared with little disruption.

6.2.3 Lengthening subscriber numbers

The lengthening of subscriber numbers is often carried out by adding a digit in front of the subscriber number. It is possible to develop a numbering plan in which number length varies by service. For example, a nine digit plan might use 10 digit numbers for (say) freephone and personal numbering services, especially if it wants to ensure adequate capacity while using three digit NDCs with strong brand recognition (such as 800 for freephone). There is a clear danger in using this strategy on its own to increase capacity. In isolation, such a strategy would eventually lead to a lack of free NDCs for numbering new services.

When planning a major change to the numbering scheme it is important to allow for the possibility that further major expansion will be required in several decades time. So it is

advisable to reserve digits to enable simple trapping of misdials when further expansion of number length is required.

6.2.4 Reducing the number of NDCs

The maximum utilisation that may be achieved in the space allocated for geographic services is dependent on the number of NDCs used. Ovum estimates, for example, that reducing the number of NDCs used from 500 to 50 can, if done appropriately, increase sevenfold the maximum utilisation that can be achieved for geographic services.

6.2.5 Closing the plan

Some countries have opted for closure of the scheme. Closing the plan is an extreme form of reducing the number of NDCs. Under the right circumstances, closure of the plan can offer:

- a single, simpler dialling procedure
- uniform number lengths and number formats making numbers easier to transcribe and dial.

But closure also leads to loss of local dialling and a need for callers to dial more digits (on average). However, with the growing use of push button, DTMF dialling from terminals with short code dialling facilities, the emphasis has moved away from minimising the number of digits which a subscriber must dial.

Loss of local dialling can also lead to loss of information to callers. But in cases where local dialling areas and local charging areas are not co-incident, this loss can be small. This loss may disappear when charging becomes independent from distance. With these trends in mind, countries contemplating a major numbering plan change should consider the advantages and disadvantages of closing their plan. They will need to consider:

- whether it is possible to close the plan without major disruption. In many open plans there is a major clash between use of the 1XX dialling space for short codes and use of the 01XX dialling space for subscriber numbers.
- the extent to which closure will increase the number of digits dialled. This will depend on the average length of the NDC and the proportion of calls made with local dialling.
- the degree of uniformity of number lengths and formats offered by a closed plan. A closed plan with non-uniform number lengths removes one of the main advantages of closure.
- the extent to which local dialling areas and local charging areas are co-incident.

6.3 Basic guidelines on non-discriminatory access to numbering resources

6.3.1 Independent numbering administration

NRAs should ensure that numbering resources are administered in a transparent and independent way. This entails the following guidelines:

Guidelines on independent numbering administration:

14. The NRA should take responsibility for the long term development of a plan, the allocation of numbering blocks to network operators and service providers and the maintenance of the national numbering plan database.
15. The NRA should publish the numbering plan.
16. The NRA should develop and publish rules for block allocation.
17. The NRA should develop and implement a policy for use of short code resources.

18. The NRA should consult a representative body on all key policy issues of numbering.

These guidelines will be further elaborated in the ongoing ETO studies on “Harmonised National Numbering Conventions” and on “Harmonisation of Short Codes in Europe”.

6.3.2 Plans for numbering new entrants

NRA should produce firm plans for numbering new entrants at least two years in advance of the introduction of competition. This gives the NRA an opportunity to identify and rectify problems before new operators enter the market.

In countries where this deadline has already passed, the NRA should develop plans for numbering new entrants as a matter of urgency. The date of 1 January 1998 for the start of competition in most EU countries must not be jeopardised.

Guidelines on numbering plans for new entrants

19. The NRA should produce firm plans for numbering new entrants preferably two years in advance of the introduction of competition.

6.3.3 Non-discriminatory access to geographic numbers

NRA should ensure that they allocate numbering space for geographic services to new entrants in a way which minimises user confusion and is not anti-competitive. ETO does not believe that allocation of operator specific NDCs (rather than number blocks from behind nationally significant geographic NDCs, common to all operators) meets this requirement. Operator specific geographic NDCs lead to:

- dialling confusion for users (open plans in particular)
- a reduction in the tariff and location information available to callers from the number
- discriminatory access to numbers. The numbers used by new entrants are less attractive to potential subscribers (and especially to small businesses which rely on local custom) than the numbers used by the incumbent. They signal non-local calls at long distance tariffs to the average caller.

NRA should make a detailed and early assessment of the supply of number blocks available for new entrants from behind all key geographic NDCs. If there are supply problems the NRA should take immediate steps to solve them. This might involve:

- local number changes to increase the length of subscriber numbers
- using 1,000 rather than 10,000 number blocks in certain areas for routing and allocation purposes
- reducing the number of geographic NDCs to increase supply.

NRA should ensure that the geographic numbers used by the incumbent and a new entrant are, for any given geographical area, of the same length. In the short term, it may be necessary to allocate longer numbers to new entrants (to ensure any supply at all). The NRA should take the necessary steps to rectify this initial imbalance at the earliest opportunity. It is to be noted that when allocating number blocks to new access network operators, number portability counterbalances the need for new subscriber blocks.

Guidelines on non-discriminatory access to geographical numbers:

20. Geographic NDCs should not be allocated to access network operators for numbering their geographical subscribers.
21. A geographic NDC should be common to all access network operators within this geographic area.
22. If in some area local dialling is allowed, it should be applicable to all subscribers with the same dialling procedure independent of the access network operator within this area.
23. The geographic numbers used for any given geographic area should be of the same length within the numbering area.

6.3.4 Non-discriminatory access to non-geographic numbers

NRAs should, when developing the national numbering plan, ensure that access codes from an N(S)N resource (NDCs in an open plan) which are dedicated to commonly recognised national services (e.g. 800 for freephone, 900 for shared revenue services etc.) are available to all operators. They should also consider carefully how much numbering space is required behind these access codes to meet the country's needs for at least three decades.

In a similar way, NRAs should ensure that a N(S)N space is available for numbering the mobile and personal services of all competing operators and service providers.

NRAs should, when developing a national numbering scheme, try to ensure that the number space allocated for use by mobile operators is clearly distinguished from the number space used for numbering geographic and other non-geographic services.

Guidelines on non-discriminatory access to non-geographical numbers:

24. NRAs should ensure that access codes from an N(S)N resource which are dedicated to commonly recognised national services (e.g. 800 for freephone, 900 for shared revenue services, etc.) are available to all operators.

6.3.5 Non-discriminatory access to short codes for carrier selection

Short codes are used for carrier selection prefixes. NRAs should ensure that carrier selection prefixes are available in good time before market entry to new entrants offering long-distance service. Carrier selection prefixes starting with digits 10 are in use or are planned to be put in use in some countries (see Annex 11). Carrier selection prefixes for carriers operating on a national level may not be an issue for harmonisation. However, in order to support easy recognition of carrier selection at a European level, it would be advisable to use the same number ranges for carrier selection in all European countries. At least prefixes for carriers operating in several European countries should be harmonised. According to the ETO study on Carrier Selection ⁵, 10X, 11X and 19X ranges could offer the easiest harmonised number space for the numbering of carrier

⁵ ETO Final Report on Carrier Selection, 30 May 1997.

prefixes for trans-European carriers, and their applicability should be studied in more detail.

Unless scarcity of short codes determines otherwise, NRAs should allocate carrier selection prefixes of the same length to all corresponding operators.

6.4 Basic guidelines on user-friendliness

There are no clear definitions for a criterion on user-friendliness. There exist conflicts between different aspects of user-friendliness in numbering. It is not possible to achieve all desirable ends at the same time - choices must be made. For example:

- Uniform numbering means that average number length is greater than would otherwise be necessary.
- Closed schemes are very simple but may lead to a dilution of information in numbers.
- NDCs denoting small geographic area give good location information and permit short local numbers, but hamper location portability and may lead to a mismatch with tariffs.
- Users rarely welcome change, even when it makes the plan more user-friendly.

In addition, it is worth commenting separately on the fit between user-friendliness in a numbering plan and other important aspects which are assessed in this study - capacity, non-discriminatory access for competitors, and harmonisation.

6.4.1 General guidelines

A well-structured numbering plan is a prerequisite for user-friendly numbering. It should enable an easy recognition of services, prefixes, geographic and non-geographic number ranges and tariff classes. Geographic and non-geographic number ranges should be clearly distinguished.

6.4.2 User-friendliness and capacity

Inadequate capacity is the most common reason to make changes in a numbering plan. It is usually achieved by, or at least accompanied by, longer numbers. As we have seen, both change in itself and longer numbers run contrary to user-friendliness. However, it may be considered that users accept change about once a decade as an inevitable concomitant of technical progress and growth. Their acceptance can be encouraged by taking the opportunity to make the plan more user-friendly at the same time as enhancing its capacity.

6.4.3 User-friendliness and competition

The purpose of introducing competition is to offer users better and cheaper services. Overall, competition must therefore be seen as user-friendly. However, its immediate effect on numbering plans is likely to be the reverse. Inevitably, more operators lead to greater complexity in plans and dialling procedures. In order to minimise the loss of user-friendliness:

- Geographic NDCs, and non-geographic NDCs or significant number ranges, should be shared among all relevant competitors so that users never encounter conflicting meanings in numbers.
- Number lengths within NDCs should be the same for all competitors (here the requirements of non-discriminatory access and of user-friendliness coincide).
- Carrier selection should be carried out by the simplest possible means and with the shortest possible codes. This points to:
 - preselection of long-distance carriers, and

- a unified carrier selection procedure for both long-distance national and international carriers (here the requirements of market segmentation and of user-friendliness coincide).
- Full set of short codes for basic services which are the same for all access network operators in a country (whether fixed or mobile) is needed.
- Wide publicity of any number range for services that are moved from short codes to E.164 numbers (such as freephone) for competitive reasons.

6.4.4 User-friendliness and harmonisation

An important reason for harmonisation is to improve user-friendliness and thereby market potential. Unfortunately, as we have already seen, any harmonisation of non-matching numbers for existing services involves change, which is user-unfriendly. Long co-existence of “old” unharmonised codes with “new” harmonised ones diminishes information in numbers and is also user-unfriendly. The following guidelines are suggested in order to achieve maximum benefits from harmonisation without undue cost to user-friendliness:

- Require clear cost-benefit or social justification for all harmonisation measures, remembering that:
 - the main beneficiaries of international harmonisation are frequent travellers, a minority in any population.
 - the costs of numbering new services in a co-ordinated, harmonised way are much less than the cost of renumbering existing services.
- Plan transitions carefully, so that where new codes are intended to supersede old ones, the old ones do not remain in use for too long.
- Give wide publicity to the rationale for and the benefits expected from any new codes.

Further elaboration of harmonisation will be carried out in ongoing ETO studies on “Harmonisation of Short Codes in Europe” and on “A long-term strategic plan for the numbering and addressing of telecommunications services in Europe”. ETO also proposes a new study on the “Benefits of harmonisation”.

6.5 Potential for harmonised service numbering

There is strong convergence on the “basic” set of 0, 00 and 112. Convergence on 118 is much less widespread, amounting to only seven countries (See Annex 12).

Further harmonisation in the potential 10X, 11X and 19X ranges would require substantial changes in several countries. In some cases, such changes are already planned.

There is a significant amount of “de facto” harmonisation of numbering for the three selected services, freephone, shared revenue and personal numbering services (see Annexes 13 and 14):

- Of the 18 countries surveyed with freephone service, 16 are already using or will soon use 800 (or a variant) to number it.
- Of the 18 countries with shared revenue service, 11 are using or will soon use 900 (or a variant).
- Of the 13 countries with personal numbering, nine are using or will soon use 700 (or a variant). A further five are using 8 as the first digit, with three of these using 87 as the first two digits.

The scope for wider harmonised use of the X00 range is however limited without code changes in several countries. There is no discernible convergence in numbering for cellular or paging services. All numbering ranges are used somewhere, with no concentration on any particular range.

7. GUIDELINES FOR FUNDAMENTAL CHANGES

Well-structured numbering schemes are considered a prerequisite for user-friendly numbering. They should enable easy recognition of services, prefixes and subscribers and thus facilitate easy remembering of numbers. New schemes should provide enough flexibility and capacity for the numbering of new, yet unforeseeable services so that the need for scheme change can be minimised.

In order to cause minimum disruption to customers the transition from the old scheme to a new scheme should be made as easily as possible. When planning new schemes, the old scheme is clearly a constraint. It is difficult to start a new plan from a “clean table”. Consequently, harmonisation and convergence of schemes at a European level is difficult because of existing national schemes. No number space exists which is common in every European country and which could be acceptable to all European countries as a basis for a “European” scheme. However, some number spaces exist which are already common in many European countries and they could offer a basis for a converging “European” numbering.

When developing their national schemes, countries face the problem of how to take European needs into account. No well defined European numbering strategy exists today. If basic European demands were defined, it would help NRAs in developing their national numbering schemes.

In this chapter, basic European demands are listed along with the most commonly used national number ranges for different types of services. These number ranges are used to provide common guidelines for NRAs when considering fundamental changes in their schemes. These guidelines are not considered as a requirement to change the scheme if no instant other need exists. An example of a structured numbering scheme is also presented. This example is intended to start discussions on the convergence of European numbering schemes and provide an input for the ongoing ETO study on the “Long term strategic plan for the numbering and addressing of telecommunications services in Europe”.

7.1 Basic requirements for a national numbering scheme

Based on the attributes defined in chapter 4, the four following items have to be considered when planning numbering schemes for competitive environment:

- Requirement of number capacity
- Requirement of non-discriminatory access to numbering resources
- Requirement of user-friendly numbering
- Requirement of European harmonisation

Each of these requirements is discussed in greater detail in the following sections.

7.1.1 Requirement for number capacity

Demands of number capacity relate to the topics of:

- number capacity for prefixes (trunk prefix, international prefix)
- number capacity for short numbers/service access codes/other prefixes
 - capacity of available 3 digit blocks
- number capacity for geographical and non-geographical services
 - capacity of blocks of subscriber numbers
 - capacity of 1, 2 or 3 digit NDCs
- free capacity for future, yet unforeseeable services

7.1.2 Requirement for non-discriminatory access to numbering resources

There are no clear definitions for a criterion on non-discriminatory access. Numbering resources should be administered in a transparent and independent way.

Demands for non-discriminatory access relate to the topics of:

- Non-discriminatory access to short numbers/codes/prefixes
- Non-discriminatory access to geographical numbers
- Non-discriminatory access to non-geographical numbers
- Equal dialling procedure for all corresponding operators and service providers
- Equal length of numbers for all corresponding operators and service providers

All these demands relate back to the capacity of numbering resources. If the scheme has resources enough, it is easy to allocate equal resources to all operators/service providers.

7.1.3 Requirement for user-friendliness

Demands of user-friendliness relate to topics of:

- stability of a scheme
- structure of a scheme (easy recognition of prefixes, services, tariffs, geographical and non-geographical numbers)
- number lengths should be the same for all access network competitors within an NDC
- shortest possible numbers/codes for the most used common services and prefixes

These demands also relate back to the capacity of numbering resources. If a numbering scheme has significant free capacity to be allocated to new services, the need to change existing numbers can be minimised because new demands can be numbered from free resources. Adequate free capacity leaves space to consider short numbers/codes and equal length of numbers.

7.1.4 Basic requirements for European numbering

Although no European numbering strategy exists so far, the following basic demands for European numbering can be foreseen:

- to enable a numbering space for harmonised short numbers and prefixes (e.g. 112, 118, prefixes for trunk calls, international calls, prefixes for selection of trans-European carriers),
- to enable common access codes for the most recognised national services (freephone 0800, shared cost and shared revenue services, personal numbers etc.). This would facilitate an easy recognition of the most commonly used national services throughout Europe,
- to enable future convergence of national schemes. This would facilitate user-friendly numbering within the European market area in the long run. In the context of the two types of schemes today (open and closed) and with reference to the possibility of closing the scheme, it is important that new open schemes should be planned in a way which does not hamper possible closing of the scheme in the future.

7.1.5 Impact of basic requirements on the structure of a numbering scheme

From the previous sections, it is easy to see that only two key requirements exist for numbering schemes in a competitive environment:

- 1) Adequate numbering resources which facilitate non-discriminatory access to numbering resources and user-friendliness and harmonisation
- 2) Requirements on common number ranges for different types of
 - harmonised “European” services (e.g. 112, access codes for “trans-European” carriers etc.) and
 - common “national” services which should be recognised as a similar service at the European level (e.g. 0800 for freephone, 0900 for shared revenue services, personal numbers, etc.)

7.2 Numbering resources for a national numbering scheme

7.2.1 Resource allocation in closed and open numbering schemes.

Numbering resource is used differently in open and closed schemes. When planning the scheme, the basic question is in which proportion resources should be reserved for different types of services. There is no exact definition of capacity needs. All figures presented are subjective in nature. However, it is clear that the more free capacity a numbering scheme provides, the easier it is to number future services, subscribers, carriers in a non-discriminatory way. Tables 2, 3 and 4 show examples of a provisional ration for resource allocation of a numbering scheme which - with the aid of huge free capacity - allows for long term stability of the scheme, for tools for non-discriminatory access to numbering resources, for user-friendly use of resources and for means for harmonisation in both open and closed schemes. It is difficult to estimate what will be the ratio between resources of geographic and non-geographic numbering resources. In the tables below, resource for geographical/non-geographical numbers have been divided in the ratio of 50/ 50 (see Annex 15 and 16 in detail). The resource allocation presented in this section, gives a framework for the scheme with a huge free numbering capacity for the use by NRAs. When defining the detailed resource allocation for different types of services, the minimum criteria described in basic guidelines in Chapter 6 should be considered.

Closed schemes

In table 2 for closed schemes, the key issue has been reserving half of the total resource for future use. The rest of the resource is used for the numbering of short numbers/codes and the present geographic and non-geographic services. For short numbers/codes 10% is reserved in accordance with the basic guidelines given in the chapter 6.

	Closed scheme
	N(S)N resource
International prefix (00); (01-09 available for other purposes)	6%
Short numbers/codes (as defined by NRA)	10%
Non-geographic numbers (blocks as defined by NRA)	50%
Geographic numbers (blocks as defined by NRA)	50%
Left free for future applications (blocks as defined by NRA)	34%
Total N(S)N capacity	100%

Table 2. A provisional resource allocation of a closed scheme

Open schemes

In open schemes two resources exist: the NDC resource and the SN resource. In table 3, the NDC resource allocation of an open scheme resembles the one made for the closed scheme. The key issue has been reserving 50% of the total NDC capacity for future applications and using the other half for the numbering of present geographical and non-geographical services.

	Open scheme
	NDC resource
International prefix (NDC 0)	6%
Geographical numbers (NDC ranges defined by NRA)	50%
Non-geographical numbers (NDC ranges defined by NRA)	50%
Left free for future applications	24%
Total NDC capacity	100%

Table 3. A provisional NDC resource allocation in an open scheme

In table 4, forty percent of the SN capacity is left free **in every** NDC. This would facilitate an easy allocation of subscriber number blocks to new operators. The first dialled digit “0” is used for trunk prefix and the remaining fifty per cent are used for the present geographical subscribers and short codes/numbers. In order to illustrate the NDC/SN resource allocation, a fictive example of allocation of NDC and SN resources is given in Annex 17.

	√ resources within each geographic NDC
Trunk prefix (first dialled digit, “0”)	%
Short codes/numbers (blocks as defined by NRA)	%
Geographical numbers (blocks as defined by NRA)	%
Left free for future applications (blocks as defined by NRA)	%
Total SN capacity within a geographic NDC	100%

Table 4. A provisional SN resource allocation within each geographical NDC

7.2.2 Number ranges for different type of services/codes

While planning their new numbering schemes, NRAs have been faced with questions such as “what number ranges should be used for different types of new services?” When planning new plans they usually study numbering schemes of other European countries and then make their own decisions. This section studies numbering schemes of different countries and defines some most commonly used number ranges for some most often used services for the consideration of NRAs.

7.2.2.1 Trunk/international prefixes

Trunk prefix (0) and international prefix (00) have become “defacto” prefixes in most European countries (see annex 12).

In open numbering schemes, ETO proposes to use digit 0 as a trunk prefix in all CEPT countries. This denotes 10% of the total capacity of the scheme. International prefix 00 is being implemented in EU countries following the EU regulations. It should be used in all CEPT countries.

Trunk and international prefixes:

25. In open numbering schemes, digit 0 should be used as a trunk prefix in all CEPT countries.
26. An international prefix 00 should be implemented in all CEPT countries.

7.2.2.2 Short numbers/access codes/other prefixes

Based on the review of short numbers/codes used in different European countries, there is no common number range or free range to be used for short numbers/access codes or prefixes. However, numbers starting with digit 1 are most commonly used for short numbers and carrier access codes (see Annex 11). If number range 1 would be used for services/access codes/prefixes, it would facilitate an easy recognition of these services in the long run.

Some countries are using and planning to use number range 10 for carrier selection. CEPT has previously recommended harmonised number ranges from range 11. In an ETNO study⁶, number range 19 was also found to be a candidate for harmonised short codes. In the short term, there is a need for the harmonisation of some European services, e.g. access codes for pan-European carriers for which the planned ETNS resource is not applicable. Number ranges 10, 11 and 19 offer a potential resource for harmonised numbers and should urgently be studied in more detail. This task has already been included in the ETO work order for "Harmonisation of Short Codes in Europe", which is scheduled to be accomplished by the end of 1997.

Short numbers/codes/other prefixes

27. Number range 1 when used for services/access codes/carrier prefixes, would facilitate an easy recognition of these services throughout Europe in the long run.
28. In the short term, the need exists for the harmonisation of some European services, e.g. access codes for pan-European carriers. Number ranges 10, 11 and 19 offer a potential resource for harmonised codes and should be urgently studied in more detail.

7.2.2.3 Mobile and personal numbers and numbers for commonly recognised services

For non-geographical services, NRAs should have the freedom to use non-geographical numbering capacity in accordance with their national needs. However, some services are commonly used in every country and - although services are national in nature - common use of numbers would facilitate common recognition of a service and therefore user-friendly numbering throughout Europe. Examples of such non-geographical numbers are mobile numbers, personal numbers and numbers for freephone and shared revenue services.

With regard to mobile and personal numbers, convergence of these numbers may be foreseen in the future. This assumption is based on the fact that in mobile networks, the mobile telephone number is separated from the network address of the terminal (or SIM), which facility is a prerequisite for personal numbering. However, mobile numbers are not considered personal numbers today. Also mobile charges may differ from charges for personal numbers. However, if this convergence would take place in the future, both mobile and personal numbers could be numbered from the same number range(s).

Based on the country review (see Annexes 13 and 14), as a long term goal, number ranges 6 and 7 could be used for mobile and personal numbers.

With regard to freephone and shared revenue services, access codes 800 and 900 are widely used or planned to be used in European countries for these services, respectively. ETO proposes that N(S)N number range 800 should be reserved for freephone services and number range 900 for shared revenue services. In addition, number ranges 80X and 90X (X=1-9) should be reserved for future use (e.g. for expansion and for service or tariff differentiation of these services)

Generally, in order to guarantee capacity for future commonly recognised services, N(S)N range X0 (in general) and X00 (in particular), should be left for the numbering of such services.

Mobile and Personal Numbers and numbers for commonly recognised, non-geographical services

⁶ First results of the ETNO/Eurescom study on Harmonisation of short codes, December 1996

29. N(S)Ns starting with digits 6 and 7 should preferably be used for the numbering of mobile and personal communications services.
30. N(S)Ns starting with X0 (X=1-9) should preferably be reserved for the numbering of commonly recognised future services.
31. N(S)N range 800 should preferably be reserved for freephone services. Range 80X should be reserved for future use (e.g. for expansion and for service differentiation).
32. N(S)N range 900 should preferably be reserved for shared revenue services. 90X should be reserved for future use (e.g. for expansion and for service and tariff differentiation).

7.2.2.4 Geographical subscriber numbers

With regard to geographical subscriber numbers, NRAs should have the freedom to allocate numbers to their operators and subscribers as they wish. In open schemes with local dialling, two resources exist regarding geographical numbers: 1) NDC resource and 2) SN resource within each geographical NDC. In the closed scheme, without local dialling, the N(S)N resource is applicable for geographical and non-geographical numbers.

Open schemes:

In the NDC resources, NDCs 0, 6 and 7 were proposed in previous sections to be used for international prefix, services/access codes/carrier prefixes, mobile and personal numbers. NDC range 1 should be left free for future expansion. It could be used to allow for an easy migration from an open scheme to a closed scheme, if this is found appropriate in the future. NDC ranges 2-5 and 8-9 could be used for geographical and non-geographical numbers.

In the SN resource, within each geographic NDC, digit 0 was previously proposed for a trunk prefix and numbers starting with digit 1 for services in general. ETO proposes that one entire number range (e.g. starting with digit 9 or any range chosen by the NRA) should be left free for future use. This free range may be needed when extending the subscriber number capacity. ETO thus proposes that within each geographic NDC, SN number ranges starting with digits 2-9 should be used for the numbering of subscribers but one number range should be left free for further expansion of the scheme.

Closed schemes:

In the closed scheme, N(S)N resources are used for both the numbering of geographic subscribers and non-geographic subscribers and services. Previously, code 00 was reserved for an international prefix, the number range starting with digit 1 for national and European services in general and number ranges 6 and 7 for the numbering of mobile and personal services. ETO proposes that N(S)N number ranges 2-5 and 8-9 should be left for the numbering of geographical and non-geographical subscribers and services on a national level.

Geographical subscriber numbers

33. In open schemes, within each geographic NDC, SN number range 2-9 should preferably be used for the numbering of national geographical subscribers. One SN number range should be left free for future expansion of the scheme.
34. In open schemes, NDC range 1 should preferably be left free for future expansion of the scheme, for example to allow for an easy migration from an open scheme to a closed scheme.

35. In closed schemes, N(S)N ranges 2-5 and 8-9 should preferably be reserved for national geographical and non-geographical numbers. One N(S)N range should be left free for future expansion of the scheme.

7.3 Convergence of schemes

The numbering schemes of European countries are inconsistent with each other. In the short term, convergence of schemes cannot be realised without a major disruption to present numbers. In the long term, this disruption can be minimised if the aim of convergence is taken into account in normal updating procedures of national numbering schemes. 'Convergence aim' needs a model scheme. This model scheme would be the target scheme to be followed when carrying out fundamental changes in national schemes.

It is difficult to propose a model scheme which takes into account all the possible future needs. Furthermore, a model scheme cannot be proposed which will be coherent with all the present national schemes. In the model scheme, the proposed number space can only be based on numbers which are most commonly used in European countries.

An example for the structure of a harmonised scheme is given in Annex 18.

ANNEXES

Annex 1

Work requirement

1. Subject: Review of National Numbering Schemes on their Openness to Competition

2. Purpose

The work requirement covers the work that the European Telecommunications Office (ETO) will conduct on behalf of ECTRA for the European Commission in the area of numbering of telecommunication services. This Annex defines the Terms of Reference for a study to investigate the openness of national numbering schemes to competition.

3. Justification

The introduction of competition with a number of new entrants entering the market, the introduction of new services, the utilisation of new technologies and the rapid expansion of mobile communications all put pressure on national numbering schemes - the oldest of which date back to the 40s and 50s - to adapt to these new demands.

Some countries which have already introduced competition have already had to carry out substantial changes. Today, some countries are revising their numbering schemes and other countries are preparing to revise their numbering schemes in the near future. Common guidelines on the openness of national numbering schemes should be urgently prepared in order to obtain equally open numbering schemes and to obtain convergence in national schemes. Well-structured, user-friendly numbering schemes are a prerequisite for efficient European telecommunications.

When developing common guidelines for developing numbering schemes, the experiences of those countries which have already changed their schemes should be taken into account. European countries, when following the common guidelines, can significantly contribute to satisfying the aim of convergence to the benefit of the European customer.

In view of liberalisation of the market in 1998, there is an urgent need for a study on the openness of national numbering schemes to competition and on common guidelines for Administrations when revising their national numbering schemes.

4. Work requirement

- (1) To assess which aspects are of importance when considering the openness of national numbering schemes to competition (e.g. empty ranges for prefixes for carrier selection, equal quality of numbers for service branding by competing operators, service providers);
- (2) To review national numbering schemes and assess their openness to competition
- (3) To develop criteria for the structure of open and user-friendly numbering schemes, taking into account their openness to competition and the convergence aim of the schemes
- (4) To develop common guidelines for Administrations when revising their national numbering schemes.

5. Execution

Work will be carried out in close co-operation with the CEC, the ECTRA PT on Numbering, ECTRA members individually and the European Numbering Forum.

The final report of the study shall be delivered to the CEC not later than 28 February 1997.

6. Deliverables

Two interim reports and one final report shall be delivered.

The first interim report shall be delivered during the course of the work, containing 1) a review of aspects of important when considering the openness of national numbering schemes to competition and 2) a review of national numbering schemes and their openness to competition. The first interim report shall be delivered by 31 August 1996.

The second interim report shall contain the draft findings and proposals for the structure of numbering schemes and guidelines for revising the schemes as they will be submitted to CEPT/ECTRA for approval. The second interim report shall be delivered by 31 November 1997

The final report shall contain the findings and proposals, as approved by CEPT/ECTRA and will include any comments individual CEPT/ECTRA members have on the implementation in their respective national regimes.

All reports shall be made available in draft form one month before a liaison meeting at which results will be discussed and approval must be given for their release.

The Commission shall receive three copies of the interim reports, while the approved final report shall be made available in 15 bound copies, one unbound copy and one copy on floppy disk in Word for Windows V2.0 format. Graphics shall be made available on separate hard copies.

7. Manpower

It is expected that this task can be accomplished in 6 man-months at expert level, including possible subcontracting.

8. Subcontracting

Subcontracts - totalling 3 man-months - may be given to external experts for the execution of parts of this contract.

Annex 2 List of abbreviations

C	Country Code
EC	Commission of the European Communities
EPT	European Conference of Postal and Telecommunications Administrations
DI	Direct Dial In
TMF	Trial Tone Multi Frequency
CMA	Coordinating Information and Communication Systems
CTEL	The European Telecommunications and Professional Electronic Industry
CTRA	European Committee for Telecommunications Regulatory Affairs
CTRA PTN	CTRA Project Team on Numbering
CTUA	European Council of Telecommunications Users Association
CU	European Currency Unit
IG	European Interest Group
IIA	European Information Industry Association
NF	European Numbering Forum
TNO	European Public Telecommunications Network Operators' Association
TNS	European Telephony Numbering Space
TO	European Telecommunications Office
TSI	European Telecommunications Standards Institute
U	European Union
SM	Global System for Mobile Communications
ITUG	International Telecommunications Users Group
ISDN	Integrated Services Digital Network
ITU	International Telecommunication Union
ITU-T	Telecommunication Standardization Sector of ITU
MoU	Memorandum of Understanding
DC	National Destination Code
MT	Mobile Telephone
RA	National Regulatory Authority
(S)N	National (Significant) Number
CS	Personal Communications Service
N	Subscriber Number
K	United Kingdom

Annex 3 Attributes for non-discriminatory numbering

Adequate capacity:

- Attribute 1: Numbering schemes should have enough capacity
- 1) to number present and future services and subscribers
 - 2) for geographical and non-geographical numbers including personal numbers
 - 3) for access codes for services and carriers
- Attribute 3: Numbering schemes should be flexible
- Attribute 16: Numbering schemes should have enough capacity for service access codes and short numbers for competitive and non-competitive services

Non-discriminatory access

- Attribute 5: Numbering schemes should be administrated by an independent body
- Attribute 6: Reciprocity and symmetry between network operators and between service providers should not be constrained on numbering grounds
- Attribute 7: Numbering schemes should guarantee the same dialling procedure for all corresponding network operators and service providers
- Attribute 8: Numbering should be transparent
- Attribute 10: Numbering schemes should allow each local network operator enough capacity to number its subscribers
- Attribute 11: Numbering schemes should allow each network operator to obtain equal numbers to number its customers
- Attribute 12: If local dialling procedure is allowed, it should be allowed for all network operators and should involve the same dialling procedure for all users
- Attribute 13: Carrier selection should be managed outside the numbering plan
- Attribute 14: The numbering scheme should allow non-discriminatory access with equal length of access code for all long distance (national and international) carriers
- Attribute 15: Carrier access codes should be as short as possible
- Attribute 17: Numbering schemes should allow for the branding of services

User-friendliness

- Attribute 2: Numbering schemes should be stable
- Attribute 4: Numbering schemes should be user-friendly
- Attribute 9: Numbering schemes should be capable of accommodating customers who want to change network operator or service provider without changing their telephone number
- Attribute 18: Numbering schemes should not constrain provider portability and geographical portability of service numbers

Harmonisation

- Attribute 19: Numbering schemes should allow for migration from national service numbers to pan-European and/or global service numbers
- Attribute 20: Numbering schemes should allow for harmonisation of service codes, carrier selection prefixes and possibly for PCS numbering to be harmonised at a European level.

Annex 4 Assessment of numbering resources

	able ographic/ r person	ailable n-geogr./ r person	ree digit ort codes ailable	mber of ee two digit NDCs	se of expanding capacity	lequate pacity?	hange under nsideration
EU-countries							
Austria	9	2	4		s	lequate	s
Belgium	0		2			ot adequate	s
Denmark	5 **)		0		s	lequate	
Finland	,4		0		s	lequate	
France	5 **)		0		s	lequate	
Germany	9 ***)				s	lequate	
Greece	5		0			ot adequate	
Ireland	7		1		s	lequate	s
Italy	8		0			ot adequate	s
Netherlands	7	5	0		s	lequate	
Portugal	1		3		s	lequate	s
Spain	3	4	0		s	ot adequate	s
Sweden	4					ot adequate	s
UK	4 *)		1		s	lequate	s
non-EU countries							
Hungary	1 *)		0			ot adequate	s
Norway	5 **)		0		s	lequate	
Czech Rep.	5	7	5		s	lequate	s
Switzerland	5		0		s	lequate	s

*) excludes space reserved for geographic services but unallocated.

**) the figure is counted in a similar way as for open schemes. However, the use of the number resource in closed schemes may be more efficient than in open schemes and the actual usable resource may be more than that presented in the table.

***) In some areas numbers are scarce due to short subscriber numbers. This can be overcome by lengthening short subscriber numbers.

Annex 5 Assessment of non-discriminatory access

	Administr. of the NNS	non-discriminatory access to geogr. numbers	non-discriminatory access to freephone	non-discriminatory access to mobile services 7)	non-discriminatory access for personal numbers	port codes for carrier selection	assessment
EU countries							
Austria	, 2), 3)		s		s		not adequate
Belgium		s	s		s		more or less
Denmark		s	s	s/no		s 5)	more or less
Finland		s	s		s	s 6)	more or less
France		s	s		s/no		more or less
Germany	adequate	s	s 4)	s	s	s 4)	more or less
Greece	, 2), 3)						not adequate
Ireland	, 3)				s		not adequate
Italy	, 3)						not adequate
Netherlands		s	s	s	s	s 8)	more or less
Portugal	, 3)			s			not adequate
Spain	, 3)	s					not adequate
Sweden		s	s	s/no	s	s 6)	more or less
UK	adequate	s	s/no		s	s 6)	more or less
non-EU countries							
Hungary	, 3)						not adequate
Norway	, 3)	s	s	s	s		more or less
Slovakia	, 2), 3)						not adequate
Switzerland	adequate				s		not adequate

- 1) Administration to be developed
2) Transparency to be developed
3) Industry consultation to be developed
4) Will be introduced by 1.1.1998
5) Equal length
6) Variable length
7) Assessment only indicative; 'yes' is given only if all operators may be assigned equal numbers in quality and number length and from the number range with an easy recognition by caller.
8) Only for new entrants. The incumbent still uses 00. This will be changed in 1999.

Annex 6 Assessment of user-friendliness

The figures in the following table refer to Ovum's report to ETO. The country assessment is based on the following Ovum criteria:

Dialling:

uniformity:	Ratings:	- 1 dialling format:	5 points
		- 2-3 dialling formats:	4 points
	
		- 8 or more formats:	1 point

Number length (domestic call)	Ratings:	- at most 8 digits:	5 points
		
		- 12 or more digits:	1 point

Local dialling:		- if allowed:	3 points
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Information in numbers:

Geographic/non-geographic distinction:

Ratings:	- first of second digit dedicated to non-geogr. services	5 points
	- contiguous part of 1st or 2nd digit(s) dedicated to non-geogr. services.	3 points
	- apparently random mix of NDCs for non-geogr. services	1 point

Geographic information - logical structure

Ratings:	- NDCs have a clear geogr. logic	5 points
	- NDCs have some geogr. logic	3 points
	- NDCs have no geogr. logic	1 point

Geographic information - tariff

Ratings:	- always clear from number whether local or national tariffs apply	5 points
	- usually clear from number whether local or national tariffs apply	3 points
	- usually unclear from number whether local or national tariffs apply	1 point

Non-geographical information

Ratings:	one base point plus one for each of the following:	
	- single dedicated numbering range for mobile services	
	- single dedicated numbering range for freephone	
	- single dedicated numbering range for shared revenue services	
	- logical choice of numbering range(s) for shared cost services	

Numbering stability

Changes in plan:

Ratings:	The score is 5 minus	
	- the total number of changes for a typical user in a city in the last decade	
	- the total number of changes for a typical user in a village in the last decade	

Operator portability:

Ratings:	- if geographic NDCs shared by all relevant competitors	3 points
----------	---	----------

- plus if all non-geogr. NDCs shared by all relevant competitors 2 points
- or if some non-geogr. NDCs shared by all relevant competitors 1 point

Location portability:

- Ratings: - more than 500,000 people per NDC 5 points
- between 100,000 - 500,000 people 3 points
- fewer than 100,000 people per NDC 1 point

The table below summarises the results:

- Overall total score > 32 relates to more than average
- Overall total score 28 - 32 relates to average
- Overall total score < 28 relates to less than average

	Total, dialling	Total, information	Total, stability	Overall total	Assessment
Austria	6	12	8	26	less than average
Belgium	10	13	8+	31+	average
Denmark	10	13	10	33	more than average
Finland	5	12	10	27	less than average
France	8	16	13	37	more than average
Germany	5	18	9	32	average
Greece	12	17	5+	34+	more than average
Hungary	11	17	7+	35+	more than average
Ireland	8	18	4+	30+	average
Italy	8	15	6+	29+	average
Netherlands	8	14	10	32	average
Norway	10	18	11	39	more than average
Portugal	7	12	7+	26+	less than average
Slovak Republic	7	12	4+	23+	less than average
Spain	11	14	9+	34+	more than average
Sweden	6	13	9	28	average
Switzerland	9	13	7	29	average
United Kingdom	8	8	7	23	less than average

+ not rated for operator portability (could add up to 5 points)

Table. Assessment of user-friendliness

Annex 7 Assessment of harmonisation

The following assessment is based on the Ovum's report to ETO. The following measure will be used:

Current harmonisation of short codes and prefixes:

Ratings: one basic point plus one point for each of the following:

- 0 for trunk prefix (or closed scheme)
- 00 for international prefix
- 112 for emergency services
- 118 for directory services (or variant 01188)

Potential for future harmonised short codes:

Ratings: how easily can 10X and 11X be made available for harmonised use?

- both ranges largely free, apart from harmonised use 5 points
- more than half of the space is free, the rest are short codes (or services) 4 points
- less than half of the space is free, the rest are short codes (or services) 3 points
- more than half of the space is free, the rest are subscriber numbers 2 points
- less than half of the space is free, the rest are subscriber numbers 1 point

Current harmonisation of non-geogr. service numbering

Ratings: one point for each of the following:

- freephone on 800 (or variant)
- shared revenue services on 900 (or variant)
- personal numbering on 700 (or variant)

Potential for future harmonised non-geogr. service numbering

Ratings: one point for each of the following:

- 800 for freephone
 - 900 for shared revenue services
 - 700 for personal numbering
- plus
- 2 points if most remaining X00 codes will be available for non-geographic services
 - 1 point if some remaining X00 codes will be available for non-geographic services

The table below summarises the results:

Total score > 11 relates more than average

Total score 9-11 relates average

Total score < 9 relates less than average

	port codes now	port codes - potential harmonisation	n-geog. services now	n-geog. Svc. potential of harmonisation	total, harmonisation	assessment
Austria	4	4	0	4	12	more than average
Belgium	4	4	3	1	12	more than average
Denmark	5	4	3	0	12	more than average
Finland	5	5	1	1	12	more than average
France	4	4	2	2	12	more than average
Germany	5	1	3	4	13	more than average
Greece	3	3	0	2	8	less than average
Hungary	2	4	2	1	9	average
Ireland	4	4	1	1	10	average
Italy	4	3	0	0	7	less than average
Netherlands	4	5	2	0	11	average
Norway	4	4	1	1	10	average
Portugal	5	5	1	1	12	more than average
Czech Rep.	3	4	2	3	12	more than average
Spain	2	4	1	2	9	average
Sweden	3	1	3	1	8	less than average
Switzerland	4	3	3	2	12	more than average
UK	4	4	2	5	15	more than average

Table 1. Assessment of harmonisation

Annex 8 Description of national numbering schemes

General

The term “uniform” in this annex means that all national significant numbers (NSN) are of the same length.

Unless otherwise stated under the relevant country, all schemes should be assumed to share the following features:

- international prefix is 00
- open scheme with trunk prefix 0
- 1XX range reserved for short codes
- geographic NDCs have a regional logic
- local competitors will receive number blocks within existing geographic NDCs

The descriptions are presented below in alphabetical order.

Austria

General description

The Austrian numbering plan is similar in many ways to the German one, even though Austria's population is a tenth of Germany's. It has approximately 1020 geographic NDC areas, with one single digit NDC (Vienna), and many 3 or 4 digit NDCs. As in Germany, local numbers vary in length within an NDC, from 3 to 7 digits (within the overall length limit of 10 significant digits). The standard expansion method is lengthening numbers within the NDC.

To date non-geographic numbering is little developed, being limited to the ranges 066 to 068 (freephone, mobile and shared cost services) and 045 (premium rate services). Competitors are free to choose their own number lengths following the allocated code. The first digits 08 and 09 will soon be free - see below.

Future plans

The ranges 07, 08 and 09 are to be made available for non-geographic service numbering, to be used in a common way by all competitors.

However, current thinking is that new entrants requiring local geographic numbering capacity will not share existing NDCs, but instead will be issued with their own destination network codes behind which they may develop any geographic structure that they choose.

Belgium

General description

Belgium has a uniform 8-digit open scheme which is now nearing its limits for both geographic and non-geographic numbering capacity. The two major cities have single-digit NDCs with 7-digit local numbers; the rest of the country is covered by 39 2-digit NDCs with 6-digit local numbers.

To date non-geographic numbering has developed in a rather scattered set of codes which happened to be free from geographic numbering, but predominantly in the 07 range.

Special features

The Belgian scheme has been exceptionally stable for a long time, but the need for major change is now recognised. There is an exact match between local dialling and local charging.

Future plans

Local numbers starting with 9, which are free everywhere, are to be made available for the geographic numbering of new entrants. This will lead to new pressure on the capacity of current geographic NDCs, which will need to be relieved within two or three years.

Mobile numbers are to be moved to currently vacant codes in the 04 range, at the same time being lengthened to 9 digits (simply by putting 4 in front). Methods for expanding all other numbers to a uniform 9 digits are currently under study.

Czech Republic

Our information here is limited by late return of the questionnaire and lack of follow-up contact with the NRA.

General description

The Czech Republic has around 160 geographic NDCs of 1 to 3 digits, with local numbers of varying length (up to the maximum NSN length of 9 digits). To date non-geographic numbering has been confined to the 060 range.

Special features

The 01X range (X from 0 to 5) is used for short codes, as well as 1XX.

Future plans

In March 1997 the Czech and Slovak Republics are due to separate their formerly integrated numbering schemes, by adding a digit to the country codes. This means that each country will have free codes corresponding to the geographic NDCs formerly used in the other country. In the case of the Czech Republic, the ranges 07, 08, 09 will be available for new uses.

Denmark

General description

Since the late 1980s, Denmark has had a closed uniform 8-digit numbering scheme. The first digit 2 and the second digit 0 indicate non-geographic services. The ranges with first digit 0 (apart from 00) and the second digit 1 (apart from 21) are reserved for as yet unknown future use; those with the third digit 0 are reserved for possible expansion to 9 digits.

Special features

The historic use of NDCs by Tele Danmark to indicate particular areas has already been breaking down in recent years with digital overlays. In 1996 the NRA carried this process to its logical conclusion by declaring the entire country a single area for numbering purposes. This means that any of the fixed network NDCs (ie 32-39 to 82-89) may be used anywhere.

Correspondingly, it is already difficult to tell the exact charge for a fixed network call from the number.

This appears to have caused few problems, presumably because of Denmark's relatively low tariffs and modest differences between local and trunk call prices.

Future plans

Apart from the emergency code, it is planned to allow every network operator his own short codes for basic services.

Denmark will be among the first countries to introduce number portability on a large scale, taking advantage of the loss of geographic meaning in numbers.

Finland

General description

The Finnish numbering scheme underwent a major change in October 1996. The number of geographic NDCs was reduced from over 70 to 13 (each of 1 or 2 digits), and the trunk and international prefixes were standardised. Because five of the new geographic codes are each of 1 digit, however, there is still little spare NDC space.

The Finnish tradition of many independent local operators, with central control kept to a minimum, is reflected in the variety of local number lengths - from 4 to 8 digits. Subscriber numbers may start with 1, except for 10 and 11.

Non-geographic codes are identified by the second digit 0, or the first digits 4 or 7.

Special features

There are two sets of carrier selection codes, one on 10X for national carrier selection and one on 99X for international carrier selection.

Premium rate services are well established in Finland on the 0600 and 0700 codes. 09 identifies the capital, Helsinki.

Future plans

Following the recent major change, no further change is currently planned. The study of number portability is however well advanced and developments may be expected here.

France

General description

A major change in the French numbering plan took place in October 1996, completing a move to a uniform closed 9-digit zonal scheme that had been contemplated since the conversion to 8-digit local numbers in the mid-1980s.

There are now five geographic zones, identified by the first digit of an N(S)N, when its value is from 1 to 5. The N(S)N which begins with digit 6 identifies mobiles and the digit 8 is dedicated to non-geographic services. Digit 7 will be used when enhanced portability (both operator and geographic) is implemented. It will create a block of potentially 100 million portable numbers. Personal numbering services may or may not be in this range.

Special features

Currently (since October 18th 1996 and until December 31st 1997) the digit "0" is the "first digit"⁷ of any French telecommunication number dialled in France (with the exception of 1X, 1XY, 1XYT and 36PQ short numbers). When competition is opened in 1998, a call-by-call carrier selection mechanism would be implemented and users will be able to select a national carrier by means of the value of this "first digit". Values 2,4,5,7,8 and 9 will be used to identify six different national carriers. These carriers will be required to provide long- distance connections for calls from and to practically any points in the metropolitan territory. Other carriers will be granted a 4 digit carrier code 1XYT.; the major carriers will also be granted such a code as an alternative dialling. The value "0" will become the code for default selection (i.e. selection by the local access operator) and France Telecom will be granted one of the six values 2,4,6,7,8 or 9⁸

Future plans

When preselection is available, the use of these single-digit codes will be reviewed.

Germany

General description

⁷ The term "first digit" is employed because the quoted digit is a first digit in the dialling sequence, but it is not the first digit of the national number (N(S)N). According to France, it is not possible to call it "prefix" because it is dialled for any call, local or long distance. The available terminology did not allow for any other solution to this problem of nomenclature.

⁸ The particular value is not yet chosen.

Germany has a large number of geographic NDCs of lengths from 2 to 5 digits (more than 5000), with local numbers of varying lengths up to the NSN maximum of 11 digits. The already crowded NDC space of the former West Germany was further congested by the absorption of the former East Germany (in the 03 range). However a few spare codes still remain.

Subscriber numbers may start with 1, but not with 11.

To date non-geographic services, offered only by Deutsche Telekom, have largely been numbered in the 01 range (parts of which are used in parallel with 1XX short code space - ie a service may be accessed from different places by dialling a single code, with or without a preceding 0). New common number ranges for all operators are now being made available mainly in the 0X00 series.

Special features

New competitors, already active in Germany, have highlighted potential shortages of free blocks of local numbers in key cities. However, the document "The provisional rules for the allocation of numbers in local networks" ensures that sufficient numbering resource will be available in the local loops in Germany. According to the Regulator, there is no potential shortage of free local numbers in the local networks.

Future plans

It has been decided that all new geographic numbers will have the standard NSN length of 10 digits (or exceptionally 11). Extensive number changes are not planned. Minor amendments will be carried out if required.

Greece

General description

The Greek numbering plan is a uniform 8-digit open plan with mainly geographic NDCs: a single one-digit NDC, six two-digit NDCs (31 to 81) and around 200 3-digit NDCs. Non-geographic numbering is little developed to date, and confined to the first digit 09. Almost the entire 0X0 series of codes is, however, free.

Special features

This study has shown a probable need for the expansion of geographic numbering capacity (due to the fragmentation of the existing capacity into many small blocks). The regional arrangement of the NDCs would permit a relatively straightforward process of amalgamating neighbouring NDCs, thereby releasing more usable capacity. However, we are not aware of any plans for developing the Greek plan.

Hungary

General description

Hungary has a uniform 8-digit open numbering plan. The trunk prefix is currently 06, but is planned to be changed to 0 in 1998. The capital, Budapest, has a single-digit NDC and the rest of the country is covered by around 50 2-digit NDCs.

Short codes currently start with 0. However, with the phasing out of analogue exchanges in Budapest, there will be no more subscriber numbers starting with 1, and short codes will be moved to this range.

Non-geographic services are identified by the second code digit 0 or 1.

Special features

Subscriber numbers do not currently start with 7, 8 or 9: these ranges are seen as available for geographic numbering. Therefore, no capacity shortages are currently foreseen.

Ireland

General description

Ireland has a near-uniform 8-digit open numbering scheme with a single 1-digit geographic NDC, around fifty 2-digit NDCs and a sprinkling of 3-digit NDCs. The first digit 03 is free and could be used for expansion.

Mobile and personal numbering are on the reserved range 08. Specially tariffed services, however, are numbered within the 1XX short code range (but with full length numbers).

Special features

The code 080 is used for short cross-border dialling to Northern Ireland.

The 08X cellular range is managed in a co-ordinated way, so that a customer can change operator by changing only the second digit of his number.

Future plans

The future of the plan is under review in the light of expected fixed network competition.

Italy

General description

Italy has an open numbering plan with nearly all its NDC space devoted to geographic numbering (there are two single-digit NDCs, 28 two-digit NDCs and 202 three-digit NDCs). Approximately 170 three digit NDCs are free.

Cellular service is numbered using various free 3-digit NDCs in the 03XX range (adjacent to others used for geographic purposes). Specially tariffed services use the 1XX short code range. There is very little free NDC space.

Special features

The Italian scheme is under pressure on all fronts. Despite a commitment to introduce competition from 1/1/98, we are not aware that firm plans have yet been prepared for the numbering of new competitors. Shortages of both geographic and non-geographic numbering space are to be expected. We are informed that the need for major change is recognised and that change is under consideration.

Netherlands

General description

Since its major change in October 1995, the Netherlands has had a uniform 9-digit open scheme for geographic numbers, with 10 digits for some non-geographic numbers.

That change took advantage of the regional structure of geographic NDCs to amalgamate small adjacent NDCs while retaining familiar code digits. The result is around 100 3-digit NDCs plus around thirty 2-digit NDCs. At the same time subscriber numbers were cleared from the first digit 1, leaving this free for short codes.

The 06 range had always been used for non-geographic services, and the change of international prefix from 09 to 00 made 09 similarly available. 08 has also been cleared for this purpose. 07, however, remains dedicated to numbering 10 major cities.

Special features

The first digit 9 has never been used for subscriber numbers. Because of this and the extra capacity created by the 1995 changes, no capacity problems are now expected for a considerable period.

Norway

General description

Norway moved in 1993 to a uniform closed 8-digit numbering scheme. The first digit 0 is however available for 5-digit non-geographic subscriber numbers ("golden numbers"). The first digits 8 and 9 are reserved for non-geographic services, and the first digit 4 is not used. This could be used for possible future expansion to 9 digits.

For the time being, the old geographic information is still present in the first two digits of fixed network numbers.

Portugal

General description

The maximum NSN length in Portugal is 8 for geographic numbers and 9 for non-geographic numbers, though 7-digit non-geographic numbers are common. Portugal has an open scheme with two single-digit geographic NDCs and around 50 two-digit NDCs.

Most non-geographic services are numbered in the 06 or 09 ranges, with 0X0 also available for them.

Special features

Because of the historic division of the country between two separate network operators (one for the two major cities and one for the rest), there have often been two codes for a single non-geographic service.

Part of 09 is also in use for short codes, but this is to be withdrawn.

Future plans

Planning is now in progress for the changes that will be required to accommodate competition, to improve user-friendliness and to expand non-geographic capacity.

Initial thinking is that new entrants will be offered their own NDCs rather than sharing the existing ones. Overall capacity is likely to be expanded by prefixing 2 (the code for Oporto) to existing geographic codes.

Slovak Republic

General description

The position in Slovakia is parallel to that in the Czech Republic (see above). Because of the separation of the two plans, from 1 March 97 Slovakia will have the first digits 2 to 6 of its NDCs free, and the first digits 7 to 9 used for geographic numbering (and in part, especially 9, also for non-geographic services). There are currently around 80 geographic NDCs of 1 to 3 digits, with NSN length varying from 5 to 9 digits.

The range 01X (X: 0 to 4) is used for short codes as well as 1XX. The 0X00 series are reserved for non-geographic use.

Future plans

Future plans are under consideration. Objectives include a decrease to 25 geographic NDCs, moving geographic numbers to first digits 2, 3 and 4, short codes on 1XX, and a fixed NSN length of 9 digits.

Spain

General description

Spain currently has very high utilisation of its uniform open 8-digit plan. It has six single-digit geographic NDCs plus around forty 2-digit NDCs.

Its trunk prefix is 9, and international prefix 07, leaving the first digit 0 of NDCs available for use for non-geographic numbering (plus a few other scattered codes). Short codes are in the 0XX range.

Special features

A severe geographic capacity shortage in Zaragoza is driving an immediate “pilot” implementation of the general changes outlined below.

Future plans

The plan is to be closed by absorbing the trunk prefix 9 into the front of the number. At the same time the international prefix will be standardised and both the 0XY (X = 0) and the 1XY ranges could be allocated for short codes. Nevertheless, all the changes are still under consideration. All national numbers will then start with 9, with most non-geographic services in the 90 range. The best way to exploit the new initial digits 2 to 8 is still under consideration.

Sweden

General description

Sweden has an open numbering plan with over 260 geographic NDCs of 1 to 3 digits, spread over all first digits except 07, which is used for non-geographic numbering. Local number lengths vary within the maximum NSN length of 9 digits (10 for non-geographic services).

Control of numbering was, until recently, devolved and little information on the scheme was held centrally. Subscriber numbers often start with 1 (but not 11). Short codes occupy the 079X and 90X ranges as well as 11X. There is little free NDC space.

Special features

Carrier selection uses the 00X range, followed by the international significant number or by 0 plus the national significant number.

Telia has used the codes 010, 020 for non-geographic numbering. These will continue in use for the time being alongside their new equivalents 070X (cellular) and 0800 (freephone).

Future plans

The international prefix is to be standardised to 00. This will necessitate a change in carrier selection arrangements, which will include preselection but whose details have yet to be decided. The future of the scheme more broadly is also under consideration.

Switzerland

General description

The Swiss scheme is a near-uniform open 9-digit scheme. Following a recent rationalisation of geographic NDCs down to a single 1-digit NDC plus 18 two-digit NDCs, there is plenty of spare NDC space.

Non-geographic numbering is concentrated on the first digits 05, 07, 08 and 09.

Special features

The 1XX short code range has traditionally been heavily used for a variety of special services, including premium rate on 15X. The NDCs 90X have now been reserved for premium rate and it is intended to make 10XXX range available for carrier selection.

Future plans

It is planned to close the scheme, presumably by changing the code for Zurich from 1 to one or two of the free two-digit NDCs. New fixed network entrants will be allocated their own NDCs (presaging a breakdown of geographic meaning, as in other closed schemes?) Non-geographic numbering will be focused on the first digits 7, 8 and 9.

United Kingdom

General description

The UK has over 600 geographic NDC areas in an open scheme and over 100 non-geographic NDCs. Since April 1995 the geographic NDCs have been of 3 or 4 digits beginning with “1” (i.e. dialled digits “01”) with new non-geographic NDCs commencing with “4” - Mobile services, “7” - Personal Numbering Services and “8” - Special Services (such as Freephone, Local Rate, National Rate). Older, existing non-geographic NDCs, commencing with various digits other than “1”, have been continued. The total NSN length is a near-uniform 10 digits for geographic NDCs with both 9 (existing pre-April 1995) and 10 (new from April 1995) digit NDCs for non-geographic NDCs.

In April 1997 the UK Numbering Scheme was further rationalised to increase user-friendliness with all new non-geographic NDC allocations made on the following basis:

- Initial digit “7” (i.e. dialled digits “07”) for all ‘Find Me Anywhere’ services (Mobile, Paging and Personal Numbering).
- Initial digit “8” for all Special Services (Freephone, Local Rate and National Rate)
- Initial digit “9” for Premium Rate Services

Migration of existing numbers for these services from other ranges will take place either by ‘market led’ demand or by specific, published dates.

Special features

As demand for geographic numbers has grown significantly, measures have been implemented to increase geographic local number capacity. Generally this has been achieved by means of shorter NDCs with longer local numbers so that the overall NSN length of 10 digits is retained.

Future plans

It has been recognised that the number of unused NDCs with initial digit "1" is insufficient for the foreseen demand for shorter NDCs. Therefore the initial digit "2" has been designated for new 'short' NDCs (generally 2 digits) for geographic areas requiring additional capacity, with initial digit "3" in reserve for further expansion should the need arise. Four cities and the Province of Northern Ireland will change to new "02" codes in the year 2000 and other NDCs in need of additional capacity will change to "02" codes as necessary.

The introduction of a Corporate numbering range with NDCs beginning with the initial digit "5" is being investigated with a view to early implementation and it is intended to introduce the direct allocation to end-users of certain Special Services numbers (eg Freephone) when the requisite technical and administrative arrangements are put in place.

Annex 9 Scarcity of resources

1) Subscriber numbers

Overall capacity of subscriber numbers

This capacity requirement is related to the length of the subscriber number. The maximum length of National (Significant) Number today is 12 or 13 digits depending on the length of the Country Code (CC) in question. It is easy to see that all the relevant capacity requirements can be met with the maximum allowed number length. Subscriber number capacity can always be increased by extending the existing number length. Subscriber numbers are not necessarily a scarce resource. Countries need only to consider what is the most appropriate number length to meet the national capacity requirements and requirements of user-friendly dialling.

Capacity of subscriber number blocks

New access network operators need number blocks to give numbers to their subscribers. These number blocks are defined by three or four first digits of the subscriber number. The amount of three and four digit blocks are limited (within the whole scheme up to 1000 three digit blocks or 10 000 four digit blocks). The amount of available blocks is limited and can, therefore, be considered a scarce resource.

Capacity of NDCs

NDCs are usually defined by 1,2,3 or 4 digits. The number of available NDCs is dependent on the length of an NDC. Generally, it can be said that the amount of NDCs is a scarce resource.

2) Capacity for short numbers/access codes/prefixes

Resource for short numbers/access codes/prefixes is a scarce resource. In the closed scheme, the whole numbering scheme consists of 10 one digit codes. Similarly, in the open numbering scheme only 9 one digit NDCs are available (NDC 0 is reserved for an international prefix and is therefore not taken into account in NDC resource). Correspondingly, the whole numbering scheme comprises 100 or 90 two digit codes or 1000 or 900 three digit codes.

The capacity of 1) short numbers/access codes/prefixes, and 2) subscriber number blocks and the way in which this capacity is used is a key element of a flexible numbering scheme.

- Subscriber number resource is not necessarily a scarce resource. Extra capacity can usually be created by extending the length of N(S)N either by extending the SN or NDC or both. NRAs need only to consider what is the most appropriate number length to meet the national capacity requirements and requirements for user-friendly numbering.
- The amount of subscriber number blocks is a scarce resource.
- The amount of available NDCs is a scarce resource.
- The amount of available short numbers/access codes/prefixes is a scarce resource.
- The capacity of 1) NDCs, short numbers/access codes/prefixes, and 2) subscriber number blocks and the way in which this capacity is used is a key element of a flexible numbering scheme.

Annex 10 Guidelines for the length of geographical numbers

Subscriber numbers

In order to have non-discriminatory access to resources, the number length of a subscriber number should be the same for all access network operators.

The available SN number capacity is dependent on the length of a subscriber number. In order to guarantee enough subscriber number capacity, the number length of a subscriber number should be at least one digit longer than is necessary to number all the relevant subscribers within the numbering area. As an example, the following rule of thumb could be applied:

Numbering area of	1 million people:	the length of SN at least 7 digits
	5 million people:	the length of SN at least 7-8 digits
	10 million people:	the length of SN at least 8 digits
	etc.	

These measures are applicable - in principle - in both closed and open schemes. In the closed scheme, SN resource refers to N(S)N resource. In addition to subscriber numbers, closed schemes enable resources for non-geographical services which in open schemes are usually numbered from the NDC resource. Therefore, the number length of closed schemes may need to be longer than the number length of the corresponding numbering area in the open scheme.

Length of a subscriber number block

Today, subscriber number blocks allocated to access network operators are usually the size of 1000, 10000 or 100000 numbers. This corresponds to blocks defined by three, four or five first digits of the subscriber number, depending on the length of the number. For assessment of the SN block capacity, a three digit block is used.

- Within a geographical NDC (within a local numbering area), the length of a subscriber number should be the same for all subscribers.

- As a rule of thumb, the number length of a subscriber number should be one digit longer than is necessary to number all the relevant subscribers and services within the numbering area.

- For assessment of the SN block capacity, a three digit block is used.

The length of an NDC

In geographical NDCs, the maximum length of an NDC depends on the length of a subscriber number behind the NDC. The length of an NDC should be defined taking into account the maximum length of a

National (Significant) Number (N(S)N). According to the present global recommendations, the maximum length of an N(S)N is 12-13 numbers, depending on the length of the country code.

In spite of this maximum limit, ETO recommends that the length of an N(S)N should not exceed 10 digits in countries with 2 digit Country Codes. This number length corresponds to a maximum of 10 000 million individual numbers and in a well-structured scheme could facilitate numbering of (say) 100 to 200 million subscribers.

To facilitate possible change from an open to a closed numbering scheme, and also to facilitate efficient use of NDC resources, the length of an N(S)N should be fixed and equal for all subscribers. The fixed length of N(S)N should be applied to both open and closed schemes.

Example: The total length of N(S)N is 10 digits

The length of N(S)N = 10 digits	
The length of NDC	The length of SN
1	9
2	8
3	7
etc.	etc.

As described earlier, the SN resource in every NDC needs to have free capacity to facilitate the numbering of new subscribers and services. In a scheme with a huge amount of NDCs, available free national number capacity is dispersed in NDCs and the free capacity of one NDC cannot be used for another NDC which may suffer from exhaustion of SN capacity. If SN capacity of an NDC is getting exhausted, and no means exist for lengthening of the subscriber number, a new NDC range may have to be allocated to the same geographic area. In the long run this may exhaust applicable NDC capacity. It can be seen that the more NDCs are used, the less flexible is the scheme. Therefore, the number of NDCs should be minimised.

- The National (Significant) Number for geographic numbers should be of fixed length.

- In spite of the maximum length of an international telephone number (15 digits), ETO recommends that international numbers in Europe should not exceed 12 digits.

- The number of geographical NDCs should be minimised.

Annex 11 Number ranges used for basic services

	Emergency	Directory enquiry (2)	Alert report	Operator	Carrier selection
EU countries					
Austria	2,122,133,144	8XX	1XX	16	XX(X)
Belgium	2, 100, 101	0Y	00 XXXXX	80,1X29,1X24	XX, 16XX
Denmark (4)	2	8, 113	7	5	XX
Ireland	2, 10022	8, 020208	019	5	X(XX), 99X(XX)
France	2, 1X	3611,3617		50	4,5,6,7,8,9
Germany	2, 110	188, 00118 (3)	17X (7)	10 (6)	0XY (1.1.98)
Greece	X	1/2	1XX	4	
Italy	2, 999	90, 1197/8	Under review		Most likely 13XY(Z)
Netherlands	2, 11X, 19696	176	X	0, 175	Planning 10XX(X)
Luxembourg	2/3, 012	7/6		10	
Netherlands	2, 0611	XXXX	XXXX	XXXX	XY
Portugal	2, 115, 117	8, 09X	X	X	XY, 19XY ⁵⁾
Spain	2, 0XX	3, 025	2	0XY	
Sweden	2, 90000	97X	short code	short code (1)	9XX or 95XX ⁵⁾
United Kingdom	2, 999	2, 153	X etc.	0	XX
Non-EU countries					
Bulgaria	0, 18, 19			12	
Bulgaria	0, 160, 166	4/5, 0123/4	7, XX2021	1/2	
Cyprus	0, 93, 94	8/9, 902	7/8	0/1	
Czech Republic	0, 155, 158	0/1, 0149	9	02, 013X	
Estonia	0, 02, 03, 04	061/5	short code	08, 007	
Hungary	0, 112 (97)	8/9	3	1	Planned 13XX
Latvia	2	8, 114	5	5, 119	
Lithuania	2, 01, 02, 03, 04	8, 09	4	5, 116	
Malta	1, 196, 199	0, 194	3	0	
Norway	2, 110, 113	0/1	5	5, 117	XX
Poland	7/8/9				
Russia	0, 02, 03, 04	009	short code	1/9	
Slovak Republic	0/5/8, 112 (99)	0/1, 0149	9 etc	02, 013X	
Switzerland	2, 117/8, 143	1, 115X	5	4	Proposal 10XXX
Slovenia	2	8	1	5, 131	
Ukraine	0, 02, 03, 04	0, 073	short code	X	

In some countries, several codes are provided for the same basic service - sometimes with clear rationale and user benefit (e.g. the Belgian use of a digit to show which of three languages the service uses), elsewhere for operational reasons which may just confuse users. Sometimes a short code is available in only parts of a country; this is obviously less desirable from a user standpoint, but was not investigated by our study.

Notes to this table

- (1) 115 reserved for operator services
- (2) Many countries have different codes for national and international directory enquiries - both are included
- (3) New numbers to be assigned on 10.6.1997. Format 118XY.
- (4) All except 112 are Tele Danmark codes only - other operators have different codes. Allocation of short codes is under revision
- (5) Planned
 - (6) The number will be changed to 0900.
 - (7) Will be substituted by 0800 numbers.
 - ni No information available

The following table is an extract from the table on the previous page. The two digits shown indicate the number ranges where services are numbered. The list of services covers only basic services, emergency, directory, fault report and operator services. Other national services are usually numbered from the same numbering space.

countries	use of 1X range for basic services
Austria	, 12, 13, 14, 16
Belgium	, 11, 1X
Denmark	, 14
Finland	, 11
France	, 12, 13
Germany	
Greece	, 12, 13
Ireland	, 11
Italy	, 11, 12, 17, 18
Luxembourg	, 17
Netherlands	
Portugal	, 14, 18
Spain	
Sweden	
United Kingdom	, 11, 15, 19
non-EU	
Romania	, 12, 13, 14, 17, 18, 19
Bulgaria	, 13, 14, 15, 16
Cyprus	
Czech Rep.	, 15
Estonia	
Hungary	, 11, 19
Latvia	
Lithuania	, 19
Norway	, 14, 18
Poland	
Slovenia	
Czech Rep.	, 12, 15
Switzerland	, 14, 17
Turkey	, 12, 13
Ukraine	

Even with only basic services the table clearly shows that number range 1 is most commonly dedicated to national services in European countries.

- SN number range starting with digit 1 is most commonly used for the numbering of basic national services.

Annex 12 Harmonisable prefixes and short numbers

	Trunk prefix	Internat. prefix	Emergency 112	DQ 118
EU countries				
Austria	0	00	Yes	No
Belgium	0	00	Yes	No
Denmark	closed scheme	00	Yes	Yes
Iceland	0	00 and others	Yes	Yes
France	closed scheme	00	Yes	No
Germany	0	00	Yes	Yes
Greece	0	00	No	No
Ireland	0	00	Yes	No
Italy	0	00	Yes	No
Luxembourg	closed scheme	00	Yes	No
Netherlands	0	00	Yes	No
Portugal	0	00	Yes	Yes
Spain	9 (to be absorbed)	07 (00, '98)	Yes	No
Sweden	0	00X (00, soon)	Yes	No
United Kingdom	0	00	Yes	No
non-EU countries				
Bulgaria	0	00	No	No
Cyprus	NI	00	No	No
Czechia	0	99	No	No
Czech Republic	0	00	No	No
Estonia	8	8, 00	Partial	No
Hungary	06 (0 in '98)	00	Yes ('97)	No
Iceland	closed scheme	00	Yes	Yes
Lithuania	1, 8	00	Yes	Yes
Malta	closed scheme	00	No	No
Norway	closed scheme	00	Yes	No
Poland	0	00	No	No
Russia	8	810	No	No
Slovak Republic	0	00	Yes ('99)	No
Switzerland	0	00	Yes ('98)	No
Turkey	0	00	Yes	Yes
Ukraine	8 (0, '97)	810 (00, '97)	No	No

The table clearly shows that the trunk prefix 0 and international prefix 00 are “defacto” prefixes in European countries. Emergency call number 112 is also implemented widely in non-European countries. Directory service number 118 is used in seven European countries.

Annex 13 Non-geographical specially tariffed services

	Freephone	Shared Revenue	Shared cost	of X00 free
EU countries				
Austria (2)	0 (2)		7, 9	
Belgium	11, 800	90	15	
Denmark				
Iceland	0	0, 700		
France	0	5	1/2/3	
Germany (3)	0, 800	0, 900 (5)	0	
Greece				
Ireland	00	50, 1559	50, 1890	
Italy	7	4, 166	7	
Luxembourg	00	98		
Netherlands	64, 800	68, 90	90	
Portugal	0, 800	64	8	
Spain		06	02	
Sweden	800	2,944,939,900		
United Kingdom	0, 800	arious, 90	5,645,990, 8	
non-EU countries				
Bulgaria	0	0		
Cyprus	0			
Czech Republic	6			
Estonia	0	0		
Hungary		91	41	
Iceland	0	0		
Lithuania	0	0	0	
Norway	0	0, 829	0	
Malta (4)				
Poland				
Russia	0			
Slovak Republic	0 (1)	98, 99, 900	Y	
Switzerland	0	5/7 , 900		
Turkey	0	0		
Ukraine	0	0		

(1) From 1/3/97

(2) No freephone service exists at the time being; for 0660 service, local tariff is used. Austria plans to use 7, 8, 9 for non-geographic service codes

(3) 130, 190, 180 to be phased out

(4) Only information available is that 08, 09 are used for non-geographical services in Malta

(5) It is likely that two of the codes (0)901 to (0)905 will be used for Shared Revenue Services as well.

ni No information available

- Service not provided

The following table shows what resources have been used for non-geographical services.

Freephone services

Number range 8 has become a “defacto” number range. 22 countries use this number range for freephone services. 800 is the most commonly used service access code (19), access code 80 is used in three countries.

Shared revenue services

Almost as commonly as freephone services are numbered from the 8 range, shared revenue services are numbered from the 9 range. 22 access codes (from 15 countries) starting with 9 are in use. The most common access codes are 900 (10 countries) and 90 (six countries).

Shared cost services

No common code can be identified for shared cost services. Most commonly used number ranges start with digits 7 and 8.

Number range (first digit)	Freephone (number of countries)	Shared revenue (number of countries)	Shared cost (number of countries)
0	2	3	2
1	3	6	4
2	1		
3			1
4		1	2
5	2		
6	4	6	4
7	1	5	5
8	22	3	6
9		22	4

Conclusion:

Non-geographical number range 800 should be reserved for freephone and number range 900 for shared revenue services in European countries.

With regard to shared cost services, their numbering is inconsistent at the moment. In order to converge shared cost numbers in the long run, they should be numbered in a similar way in European countries. While premium rate numbers are characterised by high cost, it would be convenient to number shared cost services (which are cheaper than shared revenue services) from the number range adjacent to freephone services. A candidate for such a number range could be 80X, where X differs from 0. This can already be seen from the present practices, where six countries allocate numbers for shared cost services from the same basic range as freephone.

- Non-geographical number range 800 should be reserved for freephone and number range 900 for shared revenue services in European countries.

- A candidate for a number range for shared cost services could be 80X, where X differs from 0.

Annex 14 Number ranges used for mobile and personal numbers

	ellular	ing	sonal numbers
EU countries			
Austria (2)	3, 664, 676	5, 686, 688	
Belgium	75, 95	49, 72/3	
Denmark	30, 40		2 (3)
Iceland	50		
France	66		4, 7
Germany	1, 17	X	0
Greece	94	1	
Ireland			
Italy	33, 34, 36	8	
Luxembourg			
Netherlands	65, 66		
Portugal	1, 936, 676	1, 942, 943, 944	
Spain	8/9, 70, 89, 29	40, 70	
Sweden	10		
United Kingdom	any various	any various	
non-EU countries			
Bosnia	39		
Bulgaria	?		
Croatia	?		
Czech Republic	1/2/3	0	
Estonia			
Hungary	30, 60		
Latvia	93, 94		
Malta (5)			
Norway			0
Poland			
Russia	1, 902		
Slovak Republic	1, 903, 905	90 (1)	0
Switzerland	79	74	0 (4), 878
Turkey	2		
Ukraine	X - 06X		0

- (1) From 1/3/97 (until then, 800)
 (2) Plan to use 7, 8, 9 for non-geographic service codes
 (3) Tele Danmark only
 (4) Trial service, now completed
 (5) Only information available is that 08, 09 are used for non-geographic services in Malta

ni No information available
 - Service not provided

The following table is an extract from the table in the previous page and summarises in how many countries different number ranges are used for cellular, paging and personal numbers.

Number range (first digit)	Cellular (number of countries)	Paging (number of countries)	Personal numbers (number of countries)
0	2		1
1	5	3	
2	3		
3	4	1	
4	2	4	
5	3	2	1
6	7	5	
7	4	4	10
8	3	1	6
9	7	3	1

Mobile numbers

In cellular services, there is no very clear focus on any specific number range. All the number ranges are used for the numbering of mobiles. Although the most commonly used number ranges are 6 and 9, there is no harmonisation at the moment.

In Paging, the situation is almost alike. The most commonly used number range is 6 which is used in five countries.

Personal numbers

In personal numbers, number range 7 (10 countries) and 8 (six countries) are clearly the most commonly used ranges in European countries.

- Number range 6 is mostly used for the numbering of both cellular and paging services.

- Number range 7 is most commonly used for personal numbering.

Annex 15 Structure of open/closed schemes

Types of current numbering schemes

In European countries, two types of numbering schemes exist at the moment: Closed scheme (Denmark, France and Norway) and 2) Open scheme. The structure of these schemes is presented in detail in Annex 6. This study does not assess whether the national scheme should be open or closed. Both alternatives have advantages and disadvantages. The present trend seems to be towards a closed scheme. However, when planning fundamental changes in open schemes, they should be planned in a way which allows for an easy change to a closed scheme if it is considered appropriate in the future.

Closed scheme

In the closed scheme, the whole country comprises one numbering area. Full national dialling is applied in every call and no trunk prefix exists. The first digit or two or three first digits of the scheme characterise the type of the number.

Closed scheme with full national dialling denotes only one type of numbering resource:

N(S)N resource, to be used for:

- the international prefix
- numbering of geographical subscribers
 - number blocks for competing access network operators
- numbering of non-geographical subscribers and services
 - mobile numbers (e.g. NMT, GSM, paging)
 - personal numbers
 - service access codes for freephone (e.g. 800), shared revenue (e.g. 900) etc.
- short numbers for services (emergency, e.g. 112, directory, e.g. 118, etc.)
- prefixes e.g. 10XX for carrier selection etc.

Open scheme

In the open scheme, the country is usually divided into geographical numbering areas defined by National Destination Codes (NDCs). NDCs are also used to denote non-geographical numbering areas within the country. Within a geographical numbering area local dialling is usually available. Full national dialling is needed only in calls to other numbering areas. A trunk prefix is needed in national calls.

Open scheme with local dialling denotes different types of numbering resource:

NDC resource, to be used for:

- the international prefix
- numbering of geographical areas
- numbering of non-geographical areas
 - for mobile numbers (e.g. NMT, GSM, paging)
 - for personal numbers
 - for non-geographical services, e.g. freephone (0800), shared revenue (e.g. 0900) etc.

SN resources, to be used for:

- the trunk prefix
- numbering of individual subscribers within the numbering area
 - number blocks for competing access network operators within an NDC
- numbering of possible geographical services
- short numbers for services (emergency, e.g. 112, directory, e.g. 118)
- prefixes for carrier selection (e.g. 10XX) etc.

The table below shows the basic structure of open and closed schemes.

CLOSED NUMBERING SCHEME	OPEN NUMBERING SCHEME
-------------------------	-----------------------

N(S)N (first digit)		N(S)N	
		NDC (first digit)	SN (first digit)
0 (00 int. prefix)		0 int. prefix	0 trunk prefix
1		1	1
2		2	2
3		3	3
4		4	4
5		5	5
6		6	6
7		7	7
8		8	8
9		9	9
Combination of NDC/SN may vary, for example:			
		y	xx xx xx xx(x) or
		yy	xx xx xx x(x) or
		yyy	x xx xx (x) or etc.
max. 12-13 digits		max. 12-13 digits	
Numbering space to be used for:			
geographical numbers	geographic numb.areas	geographic numbers	
non-geographical numbers	non-geographic numb.areas (e.g. mobile, personal numbering)		
short codes * services (e.g. 112, 118, 800, 900.) * prefixes (e.g. 10XX)	short codes • services (e.g. 0800, 0900) * prefixes)	short codes services (e.g. 112, 118) prefixes (e.g. 10XX)	

Table 1. Basic structure of open and closed numbering schemes

Annex 16 Resource allocation in closed and open schemes

Trunk/international prefixes

Open schemes need a trunk prefix to escape from local dialling to national dialling. In most countries the trunk prefix has been a one digit code. In open schemes, the use of a one digit code reserves 10% of the numbering scheme. In the closed scheme, a trunk prefix is not needed. International prefix is needed in both schemes.

Short numbers/service access codes/other prefixes

Short numbers, service access codes and other prefixes may be defined as a sequence of few first digits. In order to assess the free capacity of codes, the number of free three digit codes is used. The total numbering scheme denotes 1000 three digit codes. If 10% of this total resource codes is used for short numbers/codes/prefixes, it should facilitate enough resources for three, four or five digit short numbers/codes.

Geographical/non-geographical numbers

Different sources forecast a significant increase in non-geographical numbers (mobile numbers, personal numbers, service numbers). At the same time, demands for geographical numbers may increase only slightly, although new demands for DDI and for different ringing tones may lead to significant growth in the geographical numbers. It is difficult to estimate what will be the future need for geographical numbers and non-geographical numbers. In order to guarantee flexibility in schemes, resources reserved for present geographical and non-geographical numbers should not exceed 40% of the total resource of the new scheme.

Free capacity for numbering future, yet unforeseeable, services

A significant resource should be left free for future use, either geographical or non-geographical applications to facilitate flexibility and stability of schemes. 40% of the total number space should be left unallocated and reserved for future services.

Resource allocation in closed and open numbering schemes

Resource is used differently in open and closed schemes. The table below shows a provisional resource allocation of a numbering scheme which allows long term stability and tools for non-discriminatory access to numbering resources. In the table, resources for geographical/non-geographical numbers have been divided in the ratio of 50/ 50.

	Closed scheme	Open scheme	
	S)N resource	DC resource	N resources
Trunk prefix			10%
International prefix	10%	10%	
Short numbers/codes	10%		10%
Geographical numb	10%	10%	10%
Non-geogr. numb.	10%	10%	
Left free	10%	10%	10%
Total	40%	40%	40%

Table 1. A provisional resource allocation of model scheme (closed or open scheme).

In the closed scheme, N(S)N space is divided according to resource needs. There is no need for a trunk prefix and the resource needed for trunk prefix in an open scheme is almost free in the closed scheme.

In the open scheme, both NDC resource and SN resource should have free capacity. NDC space has to be divided between resources for international prefix, geographical NDCs, and non-geographical NDCs.

SN resource is usually used for trunk prefix, short numbers/service access codes/prefixes and for numbering of subscribers.

Annex 17 Illustration of the use of the geographic NDC/SN resource

Allocation	The first digit of NDC	Individual NDCs	Individual NDCs	SN resource within each geogr. NDC (first digit)	
Int. prefix	0	20	free	0	trunk prefix
Free	1	21	allocated	1	services
Geographical NDCs	2	22	allocated	2	subscribers
Geographical NDCs	3	23	allocated	3	subscribers
Free	4	24	free	4	subscribers
Free	5	25	allocated	5	subscribers
Non-geogr. NDCs	6	26	allocated	6	free
Non-geogr. NDCs	7	270	allocated	7	free
Free	8		8	free
Free	9	299	free	9	free

Applicable number length and subscriber number capacity:

CC	=	2-3	digit
NDC	=	2-3	digits
SN	=	6-9	digits, depending on the length of CC and NDC, and presuming the length of the international number as 12 digits.

Conclusion: Large reserves of free capacity (more than 50% in NDC resource and 40% in SN resource) still leave enough capacity for the numbering of geographical subscribers. In the example above, with two digit country codes and two digit NDCs, SN ranges 2-5 each provide 9 digit subscriber numbers, totalling 400 million individual subscriber numbers, and SN ranges 6-9 up to 400 million reserve **in each NDC**.

Annex 18 An example for the structure of a harmonised scheme

A proposal for a structured, harmonised scheme is presented in the table below. This proposal takes into account basic guidelines given in chapter 6 and resource allocations studied in previous sections of this report. Four number ranges are proposed to be harmonised: number range 0 for trunk and international prefixes, number range 1 for services and number ranges 6 and 7 for non-geographic subscribers, preferably for mobile and personal numbers. The rationale behind the proposal of such a large capacity for non-geographical services relates to the forecast of large expansion in the field of mobile and personal communications.

Closed scheme		Open scheme	
N(S)N range		N(S)N range	
		NDC range	SN range
0	except 00	trunk prefix	trunk prefix
1	services, prefixes ¹⁾	services, prefixes ¹⁾	services, prefixes ¹⁾
2-5	ogr. or non-geogr. numb. ¹⁾	ogr. or non-geogr. NDCs ¹⁾	ogr. numbers
6	ogr. or non-geogr. numb. ¹⁾	ogr. or non-geogr. NDCs ¹⁾	ogr. numbers
7	ogr. or non-geogr. numb. ¹⁾	ogr. or non-geogr. NDCs ¹⁾	ogr. numbers
8	ogr. or non-geogr. numb. ¹⁾	ogr. or non-geogr. NDCs ¹⁾	ogr. numbers
9	n-geogr. numbers ¹⁾	n-geogr. NDCs ¹⁾	ogr. numbers
10	n-geogr. numbers ¹⁾	n-geogr. NDCs ¹⁾	ogr. numbers
11	ogr. or non-geogr. numb. ¹⁾	ogr. or non-geogr. NDCs ¹⁾	ogr. numbers
12	ogr. or non-geogr. numb. ¹⁾	ogr. or non-geogr. NDCs ¹⁾	ogr. numbers

¹⁾ X0 and particularly X00 (X=1-9) should be reserved for commonly accepted services (e.g. freephone, shared revenue, shared cost + other future services).

Table 1. An example of a structured numbering scheme

In the table, the grey area (digits 0, 1 and 6 and 7) denotes harmonised first digits on a European level. NRAs could use other resources according to their national needs.

The proposed scheme facilitates non-discriminatory numbering in the following ways:

Capacity:

The scheme leaves the following significant free capacities for future services:

Range 1 of N(S)N and of SN is totally reserved for national and European services. It allows for hundred 'three digit' codes and a large number of longer codes to be used for national and European purposes.

Ranges 2-5 and 8-9 of N(S)N are reserved for national geographical and non-geographical services.

Number ranges 6 and 7 of N(S)N are reserved for mobile and personal numbering.

In addition to these basic N(S)N ranges (1-9), number ranges X0, and X00 in particular (X=1-9) provide user-friendly access codes for commonly accepted services.

Non-discriminatory access:

Significant free capacity allows for equal numbers to all operators and service providers from all number ranges. X0 and X00 allow for a common access code for commonly accepted services. The use of X0 and X00 is applicable to all operators and service providers.

User-friendliness

The structure of the scheme facilitates the easy remembering of numbers: 1 for services, 6 and 7 for non-geographical services (e.g. mobiles and personal numbers). For commonly accepted services

(e.g. freephone, shared revenue and shared cost services), X00-type service access codes will be used (800 for freephone etc.). Within this scheme, geographic and non-geographic numbers can be clearly distinguished.

European harmonisation

Number resources in number range 1 facilitate easy harmonisation of those services which are considered crucial and necessary to be harmonised within Europe (e.g. carrier access codes and service access codes on a European level in the long run). In the open scheme, NDC range 1 is left totally free to facilitate an easy closing of the scheme if this is deemed appropriate in the future.

Annex 19 Comments from ENF members