

Please cite this paper as:

OECD (1995-01-01), "The Economic and Regulatory Aspects of Telecommunication Numbering", *OECD Digital Economy Papers*, No. 12, OECD Publishing, Paris.
<http://dx.doi.org/10.1787/237502514428>



OECD Digital Economy Papers No. 12

The Economic and Regulatory Aspects of Telecommunication Numbering

OECD

COMMITTEE FOR INFORMATION, COMPUTER AND COMMUNICATIONS POLICY

**THE ECONOMIC AND REGULATORY ASPECTS OF
TELECOMMUNICATION NUMBERING**

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1995

024263

Document complet disponible sur OLIS dans son format d'origine

Complete document available on OLIS in its original format

SUMMARY

Over the last few years numbering arrangements for telecommunication services have become a key issue for discussion among policy-makers, regulators and telecommunication operators in a number of countries. Historically, the allocation of numbers has been seen primarily as a technical issue. Engineers at the Public Telecommunication Operators (PTOs) have had complete control over number allocation functions. In many countries, PTOs themselves have been designated as the legal entities authorised to control and manage national numbering plans and to make sure that they comply with national and international rules. Indeed, they themselves have been setting the national rules, if any, regarding number allocation.

With the advent of liberalisation, however, and the rise of competition in service provision, the issue of numbering acquired important economic, political and commercial dimensions. A major concern expressed by competitive service providers in countries where competition is being introduced, is that the continuing control of national numbering schemes by incumbent operators may increase barriers to entry to new entrants in a market and thus hinder competition. Current discussions at the national level focus on what numbering arrangements would best facilitate access of competitors to numbering resources in order for an effective competition to flourish.

Moreover, the availability of technology has opened the way to new number-demanding applications such as Freephone and premium-rate services. The defeat of monopoly power of incumbent operators and the emergence of new services, call for changes in the existing number allocation practices and for restructuring of national numbering schemes in order to provide space for future services to grow. Many OECD countries have revised, or are in the process of doing major revisions, to their national numbering plans. At the same time, the issue of setting a market for certain premium numbers and/or number ranges has come to the fore. Given the scarcity of these numbers and the increased demand by users, it is argued that market mechanisms could allow for a more efficient distribution of this resource.

There is an on-going realisation in most OECD countries that full responsibility over the administration of national numbering plans should be entrusted to a separate body other than the dominant PTO. The emergence of new players in a market has put in question traditional forms of incumbents' numbering management control. New forms of administrative structure and consensus policy-making for numbers among all parties concerned are among the proposals put forward to encourage a more efficient allocation of resources.

However, little progress has been made so far with regard to the actual transfer of policy activities to a disinterested third party. The pace of modifications in national numbering plans has varied between OECD Member countries and has been depended much upon the perceived urgency for a new numbering scheme (numbers run out) as well as on the timeframe for the introduction of competition in service provision.

This report, prepared by Ms. Natasha Constantelou (Centre for Information and Communication Technologies, University of Sussex, United Kingdom). focuses on the policy issues that arise from the

process of restructuring of national numbering schemes. Numbering is viewed not as a purely technical matter but as an issue which addresses important organisational and economic consideration for regulators and policy-makers. The report primarily consists of an analysis of the current situation and attempts to a) identify the main economic and regulatory characteristics of the process of number allocation; b) examines the experiences of certain OECD Member countries who have been engaged in reforms concerning their numbering arrangements for the development of existing and new telecommunication services; and c) provide policy recommendations on the efficient management and administration of national numbering resources.

After approval for derestriction by the Committee for Information, Computer and Communications Policy in April 1995, this report is made available to the public on the responsibility of the Secretary-General of the OECD.

Copyright OECD, 1995

**Applications for permission to reproduce or translate all or part of this material should be made to:
Head of Publications Service, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France.**

TABLE OF CONTENTS

SUMMARY	1
CHAPTER 1: TELECOMMUNICATION NUMBERING AS AN ECONOMIC RESOURCE	6
1.1 The functions of numbers	6
1.2 Numbering and competition	7
1.3 Numbering as a national resource	9
1.4 Value intrinsic in numbers.....	10
1.5 The need for new organisational schemes and re-regulation.....	12
CHAPTER 2: THE REGULATORY ASPECTS OF NUMBERING	13
2.1 National numbering authorities.....	13
2.2 Numbering policy and planning.....	15
2.3 The administration and management of numbering schemes.....	16
a) Number allocation	16
b) Number Reservation.....	16
c) Publication of numbering schemes	17
d) Number trading	17
e) Charging of numbers	18
2.4 Portability of numbers	21
a) Types of portability	21
b) Regulatory aspects of portability	23
2.5 Directory services.....	25
a) General issues	25
b) The United Kingdom experience	25
CHAPTER 3: INTERNATIONAL AND REGIONAL REGULATORY SYSTEMS AND NUMBERING MANAGEMENT IN OECD MEMBER COUNTRIES	27
3.1 The International Telecommunication Union.....	27
3.2 European regulatory initiatives	29
3.3 Numbering in the OECD Member countries	30

CHAPTER 4: CONCLUSIONS AND POLICY RECOMMENDATIONS	33
4.1 Guidelines for the short term	33
4.2 Guidelines for the long term	35
ANNEX 1: RESPONSES FROM OECD MEMBER COUNTRIES	36
NOTES AND REFERENCES	43
BIBLIOGRAPHY	43
Figure 1. Organisations responsible for the regulation of numbering in OECD countries	31

CHAPTER 1

TELECOMMUNICATION NUMBERING AS AN ECONOMIC RESOURCE

The rise of new services and the advent of competition have given to telecommunication numbers a significant economic dimension. Any economic considerations around numbers arise for two main reasons:

- First, a fairly administered numbering plan can facilitate competition in service provision and thus bring benefits to users by reducing tariffs and by increasing the quality standards in services provided. In order for competition to flourish, however, operators and service providers should be treated on an equal basis regarding access to number resources. Proprietary rights over numbers could hamper competition and prevent the growth of niche markets in service provision.
- Second, numbers become important tools in the hands of value-added service providers. Given that most of these services are highly profitable for operators, the allocation of specific number ranges to provide exclusive access to services such as mobile telephony, personal communication and premium rate services increases value of numbers. Moreover, it is recognised that a limited range of numbers contain "higher" value than others because their memorable structure brings benefits to the called party. The possible exploitation of the true market value of such numbers has been an issue of discussion for the administrators of national numbering schemes.

This part of the report examines the commercial value of numbering space. Since access to number resources is being increasingly recognised as an act which entails important economic implications for both users and service providers, the question of who owns numbering resources and who sets the rules in number allocations practices acquires significant economic and social dimensions.

1.1 The functions of numbers

National numbers are sets of digits which, when dialled, signify the most appropriate network routing in order to provide access to network subscribers or telecommunication services within a country. International numbers perform the same operation in a world-wide scale, that is, they provide access to telephone subscribers or telecommunication services to different parts of the world. Under internationally agreed conventions, the structure of an international number consists of a) the country code (CC), which indicates the destination country, b) the national destination code (NDC), which is used to indicate a particular area within a country, and c) the subscriber number.¹

Country codes have been allocated by the Telecommunication Standardization Bureau of the International Telecommunication Union [TSB-ITU, formerly International Telegraph and Telephone Consultative Committee (CCITT)]. According to the scheme, the world is divided into 9 world numbering zones, with starting digits 1 to 9 to indicate continents or greater geographic regions (for

example, digit 1 indicates North America and the Caribbean, starting digits 3 and 4 indicate Europe, etc.). The allocation and administration of country codes is a responsibility of the ITU, while national destination codes and the assignment of subscriber numbers are within the responsibilities of national numbering plan administrators. Thus, there is little or no harmonisation of the existing national numbering plans. Often, there is no similarity between the access code to the international network and prefixes for network and service selection used in one country and those in use in other countries. Similarly, national number lengths vary, with numbers in most countries being 7, 8 or 9 digits long.²

Within each country, telephone numbers can provide information on the geographic location of the called party, the tariff associated with the call, the type of service the caller has access to, or a combination of the above. For basic telephony, countries use the same geographic system where area codes contain information about the location of the calling party. Since in most countries tariffs are still tied to the routing of calls and to the distance associated, this geographic system of numbering provides the basis for estimating their tariff. Certain services, such as mobile telephony, paging, freephone and premium rate services, because of their nature, do not relate to particular geographic locations. Access codes and numbers associated with these services have no geographic significance. These numbers in most numbering schemes have charging information and service information embedded in them due to their identifiable access codes. An example would be the freephone numbers whose recognisable code signals that there is no charge for the user. There are cases, however, where providers of non-geographic services have the flexibility to make their own arrangements in the number ranges they are allocated, so as to provide users with some information about the location of the called party. In New Zealand, for instance, the two cellular operators Telecom Cellular Ltd and Bell South New Zealand have been allocated the codes "025X" and "021X" respectively for subscriber access to their cellular mobile services. Both operators have arranged so that the last digit (X) of the code corresponds to the geographic location of their cellular switches.

In the above example, apart from the charging and type of service information, the two different access codes indicate to subscribers the identity of service providers who handle their calls. In a single operator environment such information is unnecessary since all calls are routed through a specific network designed by the operator of the service. In a duopoly or multi-operator environment, however, this information is highly relevant. In such circumstances, numbering and its allocation is not regarded as simply a technical phenomenon but as a problem that has important economic and policy dimensions.

1.2 Numbering and competition

The majority of OECD countries have already experienced changes in their telecommunications policies with the advent of competition. The United States, Japan, the United Kingdom, and Finland have been at the forefront of pro-competition arguments and have introduced competition in most telecommunication services markets. In the United States, competition at the local loop level has slowly started to emerge. The operation of cable telephony services in areas serviced by RBOCs is also expected to promote competition at the local loop so that Local Exchange Carriers (LECs) will no longer have exclusive rights in basic telephony service provision within their territories. Most countries of the European Union have agreed to introduce competition in basic voice services by 1998. In Australia, the Government has announced its intention to change the existing duopoly regime between Telecom and Optus and allow more players in the market after 1997. Liberalisation in New Zealand has allowed competition in local telephone service between the incumbent Telecom New Zealand and Clear Communications Ltd., while a number of operators have expressed their interest to enter other market segments in the near future.

As competition emerges service providers and new entrants will need to have access to numbers on an equal footing. The principle of equal access, however, is difficult to put into practice, especially where incumbent PTOs have complete numbering management control and dominate numbering related decisions. Experience from countries where the issue has been debated indicates that incumbents may use numbering in an anti-competitive way. By imposing unnecessary rules and conditions for access to alternative networks, dominant operators establish artificial barriers to entry for new entrants and thus hinder competition. Meanwhile, any disputes on numbering issues between new entrants and the incumbent usually benefit the latter since they may delay new entry and thus limit a competitor's market power (Ministry of Commerce, New Zealand, 1992).

In practice, the search for numbering arrangements that would best facilitate competition has initiated numerous debates in most OECD Member countries. The experiences may vary according to the commitment shown by regulators to intervene and guarantee fair and non-discriminatory access to number resources. Still, a number of competition issues need to be considered.

Where competition in long-distance and international services has developed, a usual method for carrier selection is the use of access codes or Carrier Identification Codes (CICs) which identify the network where the call is being processed and can give routing and billing information to the customer. This method is extensively used in countries such as the United States, Finland and Japan where national regulatory authorities have assigned codes to carriers. Each international and long-distance carrier is granted an identification code which should be dialled before the digits of the international number. The access code method, however, if applied only to new entrants, establishes an artificial differentiation among operators and gives a competitive advantage to the incumbent. Unless both the incumbent carrier and the new entrants have been assigned access codes, all of equal length, the requirement to dial extra digits is undoubtedly a discriminatory practice for the new carriers.

Equal access, on the other hand, assumes that all carriers are treated in an objective and non-discriminatory way. The establishment of a pre-subscription method, where callers could pre-select the carrier of their choice can provide better guarantee for equal competition. Most numbering schemes give customers both options, that is, they provide for a choice of operator on a pre-subscription basis and allow the use of access codes to override pre-subscription and provide access to other networks on a call-by-call basis.

Equal access is not achieved when an operator, as for example Telecom New Zealand, which manages the numbering scheme, has itself set certain conditions for availability of pre-subscription only in the case where competitive operators have achieved a required market share defined by the incumbent.³ Since no operators have reached that figure, pre-subscription is not available in New Zealand, at the expense of users and service providers.

As far as local service competition is concerned, it is widely accepted that integrated numbering is crucial to competition. A common practice is for particular blocks of numbers from the numbering plan to be allocated to competitors. This is a practice widely used in countries such as the United Kingdom, Finland, Australia and recently in New Zealand. It is recognised that the number of blocks allocated to each operator should correspond to its share in the market and that any allocation arrangements should take place in a fair and timely manner. However, where management of numbering schemes is undertaken by PTOs there is no way to guarantee that bilateral agreements between the parties concerned would not place a competitor in an inferior position than that of the incumbent and, thus, hinder rather than foster its growth. Such cases could be, for example, a delay in the allocation of number blocks or the allocation of small blocks of numbers to service providers that would be inflexible to plan and more difficult to

administer. In local service provision, however, a major barrier to competition is the compulsory change of a customer's telephone number when he shifts to another operator.

The above situation of discriminatory behaviour is likely to emerge with regard to the competitors' access to value-added services. Given the commercial value of these services it is expected that operators who dominate the market would like to preserve their position and the profits they gain. By creating artificial obstacles to competing service providers who want to offer similar services they maintain the control over the emergence of competition and even prevent it where possible. An example in this case is the exclusion of Mercury from BT's 0800 Freephone range.

In the United Kingdom, Mercury and other operators had to apply to BT for numbering space.⁴ When Mercury requested numbering space in the "0800" range used by BT for its Freephone service, BT claimed copyright of the code and prevented Mercury from having access to a code which had already established a commercial profile among users (Mercury, 1993). Moreover, BT has made allocations for its customers of various numbers across the "0800" range leaving thus no complete blocks for use by other operators (OFTEL, 1993b). Given the significant financial benefits of freephone service provision, Mercury decided to develop an alternative freephone service for its own customers engaging itself in a significant commercial investment. Today, two codes are currently in use in the United Kingdom for these services, "0800" for BT and "0500" for Mercury, while there is a widespread support among interested parties for a common United Kingdom Freephone number and the opening up of "0800" range to all operators.

In New Zealand, a similar problem occurred with respect to the allocation of access codes for cellular services. Bell South, the only competitor in cellular services to the dominant Telecom Cellular, had been allocated by Telecom the codes "0213", "0214", "0216", "0217" and "0219" of the range "021X" to provide access to its cellular service. Its competitor, which is a subsidiary of Telecom New Zealand, had been assigned the entire "025X" range and was able to attach a geographical significance to the codes that would permit it to introduce tariff differentiation in the future. This obvious discrimination against Bell South was settled after intervention by the Ministry of Commerce.

1.3 Numbering as a national resource

The proliferation of numerous other entities, apart from the dominant carrier, and their involvement in a country's telecommunication industry have increased demand for numbers and consequently their commercial value. As competition increases and new numbering requirements emerge it becomes universally recognised that *"telephone numbers are a national resource and should be for the customer -- not for the operators to brand"* (OFTEL, 1993a). New operators and service providers need to have access to numbers and have the right to utilise them in a way that best suits their needs and can facilitate service provision. In this respect, proprietary rights over numbers by the ex-monopoly operators prevent equal access to number ranges and impede competition.

The notion of equal access for new market entrants includes also equal access to numbers whose particular characteristics make them attractive to users. The usual method for distribution of these "golden" numbers to end-users has been on a "first come, first served" basis. This approach, however, is inefficient when the list of potential candidates is long and resources are limited. Especially, if there is no limit on the quantity each customer may obtain, it is possible that a single user can allocate for himself more numbers than appropriate. In a multi-operator environment, where operators are allocated number ranges and then offer these special numbers to their subscribers, later market entrants may be less able to

provide such numbers. For these reasons, the issue of commercial exploitation of these resources has finally derived particular attention.

1.4 Value intrinsic in numbers

It is obvious that all number ranges available in a geographic area do not have the same value to users. For the purpose of our analysis, we divide "users" into four broad categories: residential users, community users (including government agencies and social welfare groups), corporate users, and operators/service providers. For residential and community users numbers are means for communication. Their value lies on the fact that users can access and be accessed by other people. Numbers are, thus, significant to these users from a social point of view. For corporate users and operators/service providers, however, numbers represent more than simple communication routes. Companies use numbers in their advertising campaigns and some may rely on these numbers to increase their customer base and revenues. For operators and service providers numbers represent the only means of "doing business". They are the "interface" which permits subscribers to have access to the operator's network and make use of the services it provides. For these two categories of users numbers are significant from a commercial point of view.

This commercial value, nonetheless, is not homogeneous among numbers. Certain numbers are easier to remember and dial than others and give their owners a competitive advantage in terms of marketing their products or services. An example can be taken from the area of premium rate services. If, in the case of two competitive service providers providing live information services, the first has been assigned an easily memorable number for callers while the second has an ordinary number, the provider with the most "user-friendly" number has more chances to obtain higher profits than his competitor, irrespective of the quality of service he provides. This is particularly the case for all services that use their contact numbers as primary marketing tools.

From an economic point of view, this is a case where a differential rent exists, but since there are no charging mechanisms to recover the value intrinsic of premium or special numbers its existence is not apparent. One could also argue the existence of a scarcity rent in the availability of certain numbers, in the same way as scarcity rents are created in the case of shortage of radio spectrum space. Numbers with particular significance to users, golden or special numbers, are a scarce resource. On the other hand, their demand increases in parallel with the evolution of new services and eventually the demand for such numbers exceeds their supply. The emergence of a scarcity rent in this case relates to the scarcity of the specific numbering resources.

The above raise concerns over whether establishing a market for certain numbers or number ranges would be useful in terms of making users aware of the "economic value" of these numbers. If the allocation of such numbers is free then there is no signal to indicate their intrinsic value to users -- especially to corporate users and value-added service providers -- except that some may get higher profits than others because their contact numbers are more attractive to callers. Moreover, the emergence of alpha-numeric telephone numbers in some countries would intensify the problem given that most of them are considered as premium numbers. Establishing appropriate mechanisms based on market criteria would sort out candidates according to their desire for a particular number.

A further issue is whether market mechanisms should also apply to all number ranges dedicated to value-added and special code services, such as the Freephone or premium rate number ranges. The argument for this is that value-added services are a special category of services where profits are relatively high and competition is generally intense. The lack of a price in numbers tends to favour the provision of new services even though their share in the market may be fairly limited. Such services, whose success is

in doubt, occupy significant number space, and may restrain other services from expanding. Imposing a fee for access to these ranges may discourage any inefficient use of numbering space and compensate for the value intrinsic of the resource. The question that arises here is how to put this principle into practice, since there is always the danger that it may have the opposite effect than that anticipated. In other words, it may hinder rather than foster the development of new services by increasing the barriers to entry to entrepreneurs who wish to enter a market.

Golden, or premium numbers, can be found in any range, and in any type of service. As indicated above, within a number range dedicated to premium rate services there are numbers which are expected to be valued more than others owing to their distinctive and memorable digits. The same applies to similar numbers in ranges dedicated to other value added services, such as paging services, freephone etc. Such numbers are also found in ranges reserved for basic telephony services. A memorable telephone number, for example, may be of particular importance to a government agency, a small business, or even to a residential user. This last point raises important questions:

- a) Should users pay for special numbers or number ranges irrespective of the type of service these numbers have been reserved for? If these numbers belong to a value-added or basic telephony service range would that make a difference in their pricing?*

In Australia, AUSTEL, the regulatory body in charge of the numbering scheme has been considering the option of introducing market mechanisms in number allocation since 1992. In its policy document on number charges issued in January 1994 it states that "*charges to recover the value intrinsic in numbers may be levied only in respect of number ranges as specified in Schedule A of this Policy*" where Schedule A presents a list of the following services: satellite telephone, mobile and paging services, special network services (premium number special network services), freephone, Universal Personal Telecommunication Services (UPT), facsimile, and live information services. Basic telephone services are not included in the list, therefore, special telephone numbers addressed to the wider public are not subject to any type of charge (AUSTEL, 1994a). AUSTEL's policy applies to secondary (and tertiary) allocators, that is to operators and service providers who make individual allocations to their customers, and leaves them the right to decide the level and method of charges.

- b) Should the same charging principles be applied to all users?*

Concerns may be raised over whether all users should be charged for the allocation of special numbers or certain categories of users should be exempted. For example, government users, welfare groups or even certain cases of individual users could be regarded as exceptions to the rule. A first reaction from the users' side comes from a government body in Australia which proposes that "*commercialisation policy should provide range of premium numbers to government at no charge*" (AUSTEL, 1992a). In this case, social welfare is expected to supersede the market. Pricing is viewed as a necessary mechanism to ensure efficient use of numbers but as applied to users of the private business sector and those individuals who get high profits out of the use of premium numbers. This implies that other methods need to be found for non-commercial users, where market mechanisms do not coincide with public policy objectives. Ultimately, a common accepted resolution to the problem would be the introduction of a "dual-system" where users would be separated into categories as those described previously. Then market rules would apply to all "commercial users" of premium numbers while non-commercial users would either pay a nominal fee associated with the use of such a number, or pay no special fee at all.

1.5 The need for new organisational schemes and re-regulation

The notion of numbering as a national resource that can facilitate the introduction of competition involves important economic and commercial implications that need to be considered by all players in a market. Therefore, the conventions where all responsibilities for planning, management and allocation of a country's numbering resources were conferred upon the national TO can no longer be sustained. More and more countries recognise the need to establish a numbering organisation structure independent of the incumbent operator and to seek a wider consensus among users groups and service operators involved in numbering issues.

It took considerable time for regulators to realise the mismatch between their calls for competition and the current practice of number branding by network operators. As in the case of frequency spectrum, it was as if the introduction of competition was programmed without previously considering the potential obstacles due to the lack of numbering resources and their inadequate administration by the dominant players in the market (OECD, 1993). In spite of an initial delay, the transfer of responsibilities over numbering from PTOs to independent authorities has been a matter of discussion in many OECD countries. A number of OECD countries such as the United States, the United Kingdom, Australia, the Netherlands, France and New Zealand, as well as the European Union, are currently seeking new forms of institutional organisation that would match with new objectives and criteria for number allocation. In the light of competition trends in the telecommunication industry, the issue of efficient administration and management of numbering resources has finally derived particular attention. The following chapter gives an overview of the main administrative and managerial issues surrounding numbering, as they emerge from discussions in countries which have been engaged in numbering review activities.

CHAPTER 2

THE REGULATORY ASPECTS OF NUMBERING

International policy trends in the telecommunication industry have called for a separation between regulatory and operational functions in the telecommunication sector. With regard to the numbering issue, there is a strong consensus among interested parties -- national regulators, competitive service providers and end-users -- that control over numbering schemes should be transferred to an independent entity in order to prevent anti-competitive behaviour from dominant PTOs. Many OECD countries, such as Australia, Finland, France, and the United Kingdom have proposed a schema where national regulatory authorities would be responsible for the administration and management of the number resource. Other countries such as the United States, Mexico and New Zealand have adopted a more "reactive" approach where industry participants, users and regulators seek to reach consensus over numbering matters. The shift to new forms of numbering organisation structure and the forthcoming changes in the methods by which numbers were administered have revised new issues for discussion.

2.1 National numbering authorities

Numbering is a dominant feature of the telecommunication infrastructure which incorporates policy and planning activities. It also incorporates administrative and management activities such as the assignment of numbering resources to operators/ service providers, the publication of numbering schemes, etc. Such activities can no longer be entrusted to incumbent PTOs. The complexity of the telecommunication environment today and the emergence of new services and technologies call for a consensus among the players in a market upon the way numbering schemes are developed. An independent body responsible for the administration of national numbering resources is recognised as the most appropriate solution to ensure fair competition.

Many OECD countries have announced their plans to take number planning functions away from PTOs and give them to independent regulatory bodies. The European Commission, in its Common Position on the application of ONP to voice telephony, has clearly stated that "*Member States shall ensure that national telephone numbering plans are controlled by the national regulatory authority, in order to provide for fair competition*".⁵ Little progress, however, has been made in the European Union area with respect of the transfer of responsibilities from PTOs to an independent authority, with the exception of the United Kingdom where the transfer of responsibilities from BT to OFTEL is expected to be completed in June 1994. In the European Union, the European Telecommunication Office set-up under the responsibility of ECTRA will be assigned numbering as a key task.

In North America the situation is quite different. Bellcore, an entity owned by the Bell Operating Companies (BOCs), has been assigned the function of administering the North American Numbering Plan (NANP) since divestiture of AT&T in January 1984. The NANP is the numbering plan for World Zone 1 (WZ1) which consists of 18 different countries, including the United States, Canada and most of the Caribbean. Bellcore has been subject to the plenary jurisdiction and oversight of the appropriate regulatory agencies of these countries.⁶ From the time it has undertaken full responsibility

over the administration of NANP, Bellcore has initiated a number of consensus processes among members of the world's largest and most competitive telecommunication market, in order for the industry to agree on common numbering action plans (Bellcore, 1993a). Recently, Bellcore has put forward a proposal on the future of numbering in WZ1 which includes modifications to the existing numbering structure in order to create sufficient numbering space for the future. Bellcore has started a "contribution-driven consensus process" with the aim to establishing a framework of action for all identified issues where consensus among interested parties has not been reached (Bellcore, 1993a).

However, Bellcore's ability to administer fairly the NANP is currently being challenged by carriers and service providers who base their criticisms on Bellcore's relationship with BOCs. Discussions are under way with regard to an alternative model for a new numbering organisational structure that would replace Bellcore in the administration of the NANP. The industry is keen to obtain full control over numbering issues, which will exercise through a committee composed of representatives of major industry entities. Although no final agreements have yet been reached, the conception of an industry-led organisation responsible for numbering is quite innovative. Major US-based telecommunication companies, such as AT&T, MCI, GTE, and Sprint, are those who favour a numbering organisation structure under the sponsorship of the industry. Yet, in spite of the wide US-industry support in this proposal, there are important matters that need further discussion. How can a wide industry participation be ensured so as to cover the whole of WZ1? Furthermore, what participation mechanisms could guarantee that small operators/service providers would not be overwhelmed by the "big players" and that the majority would not impose its views on the minority?

The option of entrusting decisions on numbering issues to an industry body composed of major industrial players was also considered in New Zealand but was not seen as the most appropriate arrangement in this case. A report prepared by the Ministry of Commerce, in November 1991, proposed four options for the administration of number resources: a) Telecom New Zealand would remain in charge of numbering matters; b) a Government regulatory body could take control over numbering policy; c) an industry forum could solve numbering related issues; or d) a consultative body representing a wide range of industry participants, regulators, and user groups could be established to discuss numbering issues and would be the mediator between the industry and the Government, although the latter would still retain the final responsibility. A wider consultation process that took place among the parties concerned revealed a preference towards the setting up of a consultative body to assist in the resolution of numbering issues. The New Zealand Telecommunications Numbering Advisory Group (NZTNAG) was set up in March 1993 with membership based on a voluntary basis and has since contributed to the resolution of numbering debates.

Other countries consider that numbering resources should be centrally administered by authorised State agencies. In Japan, numbering issues are studied by specially formulated study groups under the supervision of the Ministry of Posts and Telecommunications. These study groups consist of new common carriers (NCCs), industry representatives, users and technical experts. Last, but not least, AUSTEL, the Australian telecommunication regulatory body has undertaken complete control over numbering of telecommunication services from Telestra since July 1991. The Australian case is significant because, although competition in basic service is still limited (Telestra and Optus operate as a duopoly), AUSTEL has done a lot of preliminary work in the area of numbering and has produced relevant documentation on consultation processes, a draft numbering plan, and a survey on users' attitude to the proposed modifications.

2.2 Numbering policy and planning

Where competition exists, the development of efficient numbering practices requires a wide industry and user involvement in order for policy makers to identify new issues affecting the telecommunication sector with immediate impact on numbering, such as the emergence of new services and the changes in demand. Normally, such policy functions are within the responsibilities of the regulatory authorities which deal with all numbering planning and administration issues.

In the United States, however, the current trend is for a clear division between policy and administration development functions. Preliminary discussions over the issue reveal that, in terms of general principles, all industrial participants acknowledge as primary policy functions the effective planning of numbering resources for future uses, the promotion of industry-wide dialogue over numbering issues and the monitoring of compliance with industry approved guidelines (Bellcore, 1994). On the other hand, the process of allocation requests, the assignment of numbering resources, and the publication of allocation records are considered as purely administration functions. Such a distinction is preferred by those service suppliers who wish for an industry-sponsored organisation to take responsibility for numbering issues and leave Bellcore dealing with the administrative functions.

In Europe, similar considerations are just beginning to emerge. Most countries agree that regulators should have an administrative and co-ordinating role and need to guarantee equity and transparency in number allocation procedures. This, however, does not necessarily impose on them any obligations with regard to the actual preparation of any new numbering plan. For example, in France, France Telecom has recently prepared a new numbering plan for the future. The plan -- which provides for all operators and service providers to have access to numbers -- has been submitted to the national regulator (DGPT) for consultation and final approval. In Norway, Norwegian Telecom prepared a new numbering plan and presented it to the country's regulatory authority which has been responsible for numbering administration since April 1994. There are two basic reasons that justify such policies. First, national regulatory authorities often do not have the resources and expertise required for dealing with the technicalities of preparing a new numbering plan since these functions were traditionally among the PTOs' responsibilities. Second, competition in basic service provision, that encourages demand for numbers to be allocated in a transparent and non-discriminatory manner, is only slowly emerging in most OECD countries.

Planning is a principal function in number administration. Of primary importance is the efficient use of existing numbering resources as well as their long-term planning in order to ensure adequate capacity of number blocks at all times. Regulators state their intentions to ensure that any increase in the number supply will be able to cover future needs. Long-term planning activities in a competitive environment also include identification of a possible exhaustion of access codes for carrier selection. The United States has started to experience such a situation, since demand for Carrier Identification Codes for long-distance and international traffic exceeded all expectations and over 800 out of possible 969 codes are already assigned. Code conservation is a necessary principle in the administration of numbering resources and is necessary to be considered by countries who plan to introduce network competition in the near future. Moreover, liaisons of national regulatory bodies with other regional and international numbering standards authorities are necessary in order to ensure conformance with international standards and to provide users with access to future world-wide applications.

2.3 The administration and management of numbering schemes

Some OECD countries, such as Australia, France, and recently, the United Kingdom have published relevant discussion documents where they establish a framework of regulatory intervention in the numbering area and seek comments on the proposed public conventions for number allocation. In the United States, discussions are taking place on the future organisational structure of NANP between Bellcore and industry delegates. In principle, these documents follow common lines with regard to the responsibilities of national regulatory authorities over the administration management of numbering schemes. The following functions have been identified as most significant:

a) *Number allocation*

Regulators in the above countries appear to support the same view: numbers are a national resource and as such should be owned by the State. National regulatory authorities should be entrusted with the management of the resource and can make primary allocations to operators who will then make secondary allocations to service providers or to end-users. Allocation practices, in general, should promote consumer interests, enhance competition, and ensure the efficient use of numbers. The difference between primary and secondary allocation rests on the fact that a primary allocation takes place under defined principles set by the regulatory authority while secondary allocation remains in the responsibility of the operator concerned. AUSTEL, for example, in its discussion paper on Numbering administrative issues clearly states that "*AUSTEL will not be involved in day to day secondary allocation procedures but may require periodic information from carriers and service providers*" (AUSTEL, 1992c).

This practice, however, can create the danger of creating similar problems as those experienced by Mercury in its numbering negotiations with BT. Established holders of an allocation could use discriminatory sub-allocation practices to their own benefit. New entrants in service provision with particular needs for "golden numbers" for their services, could be discouraged. The enforcement of more rigid rules that would establish assignment guidelines for secondary allocations, should be seriously considered by the regulators. Moreover, the establishment of an appeal process function, where the regulator is called to resolve conflicts between primary holders of an allocation and their customers, could also provide resolution to the problem. In the United States, contributions by the industry to the discussions around the numbering organisation structure propose guidelines for appeals processes. Namely, they propose the establishment of a body where the appeals should be addressed and suggest the functions it is expected to follow to resolve potential conflicts (Bellcore, 1994).

b) *Number reservation*

The case of reservation of numbering capacity has been discussed in detail in OFTEL's Numbering Conventions. According to OFTEL, among the duties of the regulator is the reservation of numbering space for future requirements, either for the expansion of existing services or for the introduction of new services. The steps followed for number reservation are the same as in their allocation. An application should be made to the regulatory authority and it has to be considered under the same principles set for responding to an application for an allocation, that is, efficiency in the use of numbers, convenience for end-users, and maintenance of effective competition.

However, new entrants should be aware of potential anti-competitive behaviour from the part of established operators. In some cases, carriers or service providers who dominate the market may take advantage of their position and reserve large blocks of numbers for their own use. Since the transfer of

responsibilities from PTOs to independent authorities is a fairly new practice, regulators often co-operate closely with dominant operators who are more familiar with the characteristics and details of the numbering plans. In order to prevent anti-competitive behaviour in number reservation safeguards should be introduced. OFTEL proposes that a reservation may be cancelled if the formal request for numbers is not made within a "reasonable" time period, without however, specifying the exact time period. Regulatory authorities could specify that time period, particularly for requests submitted by operators for expansion of their existing services, and free the numbering capacity if no formal request has been received prior to the expiration date. They could also consider the possibility of charging for reservations on a number or block basis. AUSTEL, for example, considers the option of charging fees for number reservations in a way consistent with the Australian Government's Fees Act, which provides for the imposition of a fee for the allocation of numbers. If the fee charged is quite high, it may discourage unreasonable reservations.

c) Publication of numbering schemes

Administrative authorities concerned with numbering should be responsible for the regular publication of all information concerning the blocks of numbers allocated to particular operators/service providers, the lists of reserved numbers, as well as the lists of all free number ranges. Such publications are expected to reinforce clarity and transparency in the assessment of number allocation requests and provide for better planning of all free codes and numbering blocks. Regulators are also expected to publish periodically lists of area codes, and codes allocated for geographic and non-geographic services. For that purpose, carriers and service providers are required to submit reports over the on-going usage of primary numbers allocated to them, usually on a yearly basis unless specified otherwise. The information requested includes the current status of primary allocations, that is, the numbers in use, the number of secondary allocations, details on numbers transferred by the end-user to another operator (where operator portability is allowed), any charges applied to numbers relating to the administrative costs of allocation, and the proportion of free numbers from all allocated numbering blocks. Operators are also required to report on any numbering capacity reserved and, as requested by OFTEL, to justify any continuing reservation.

d) Number trading

The exchange of numbers under a negotiated fee is an issue whose importance is well appreciated by regulators but where no common policy line has yet been drawn. OFTEL, on the one hand, maintains that because numbering is a national resource "numbering capacity allocated by the NSM (Numbering Scheme Manager) must not be traded" (OFTEL, 1994). AUSTEL, on the contrary, invites comments on its proposed policy guidelines for number trading in Australia. AUSTEL supports the argument that since numbers have a certain financial value, expressed by the amount secondary allocators charge their customers in order to recover their administrative costs, some form of number trading is logical.

Golden numbers, for example, are particularly attractive to number trading. Their additional value is based on the fact that they are easy to remember and easy for users to dial (especially if expressed in alpha-numeric form). In a market-oriented system, where there would be a price charged for primary and secondary allocations of such numbers to service providers and end-users, golden numbers would be charged an amount that would best reflect their market value. The establishment of a trading system for those numbers may have significant economic benefits for the traders. However, as recognised by regulators, there is always the danger of speculative profit earned from number trading, not only of golden

numbers but also of ordinary, geographic numbers. Moreover, number trading without the necessary administrative process that would identify traded numbers and apply new conditions of use could lead to confusion.

The issue of establishing an administrative structure that could best supervise and monitor number trading activities has been raised by AUSTEL as an issue for wider consultation. The establishment of a database for number trading administered by AUSTEL is seen as a complicated task since it requires information on secondary allocations which AUSTEL will not necessarily obtain. What is seen as a more feasible solution is that of a "certificate" that would verify that the number to be traded has been allocated by AUSTEL to a particular carrier or service provider. AUSTEL considers that the administrative costs of such a system should burden the trader, but its proposals are open to comments and suggestions by the interested parties (AUSTEL, 1992c).

A final remark by AUSTEL is that, in a competitive environment trade in numbers is also positively influenced by number portability, that is, the ability of customers to keep their numbers when changing operators. Unless portability across operators becomes possible, users will be "locked-in" to particular operators. Moreover, access to any other number range may be constrained by the fact that specific numbering ranges would be allocated to particular carriers/service providers. Portability across locations, which permit users to keep their numbers when changing locations, may also facilitate trade in numbers between urban and sub-urban areas. For example, a company with headquarters in a metropolitan area and branches in the country may trade a non-metropolitan area number where one of its branches is located, and use it in its city headquarters. However, this means that users have to come to terms with the idea that information on the location and, to some extent, on communication charges may not be apparent from the number being called under such a scheme. The issue of portability will be discussed further in a following section.

e) Charging of numbers

The issue of charging for numbers is being given consideration by regulators. The reasons are twofold: first, it is recognised that the transfer of numbering responsibilities from a PTO to an independent authority involves considerable administrative costs that have to be covered preferably by those who make use of the numbering space and make profit out of it. Second, certain numbers contain an intrinsic value which has to be explored and assessed accordingly. In a market environment, golden numbers should normally be worth more than ordinary numbers because of their limited availability and the extra value associated with the services they provide access to. Similarly, direct dial-in numbers (DDI) may have to be charged a fee that would correspond to the opportunity cost incurred when a user holds on to an entire number range at the expense of other potential uses.

The shift in the management of national numbering schemes from the incumbent PTO to an independent authority involves extra public expenditure. These costs are associated, for example, with the human resources hired for dealing with numbering issues, the external consultations that may be needed in order for the regulator to frame policy, and the representation of the country in regional and international standardization fora.

So far, the PTOs who have been in charge of numbering schemes have been sponsoring all operational functions related to the assignment of numbers to users and service providers. In return, they used to charge nominal fees for certain facilities such as, the search for special PSTN numbers, PSTN number reservation, and the connection, use and reservation of DDI numbers. Depending on the

sophistication of the network there may be other charges imposed for the use of particular features, such as "call forward" function.

The creation of independent authorities in charge of numbering administration in several OECD countries has raised concerns over their funding. A traditional approach has been that the expenses of regulators were covered by the State budget. This has been the case in countries such as the United Kingdom, the United States, and Finland. The Telecommunications Administration Centre (TAC) in Finland, which serves as the regulatory body in the country, has recently adopted an alternative approach. Since the Government decided that TAC should develop an autonomous financial structure from 1995 on, regulators were forced to consider alternative options to fund their activities. The Department of Telecommunications and Standardisation of TAC (DTS), which is the body responsible for the administration of the Finnish numbering plan, thought the most appropriate solution was to impose fees on the right of use of numbers. According to TAC, the yearly expenses of the DTS approximate 14.4 million FIM (MFIM), of which 13.1 MFIM are expected to be covered out of numbering fees. Moreover, numbering fees are expected to contribute to the membership costs of TAC in international organisations such as the ITU, ETSI and ECTRA.⁷

From a theoretical point of view, it may seem fair that end-users should pay for the cost of managing numbering space since they benefit most. The majority of OECD countries have not given much thought to this concept since few countries have set up number administrative agencies independent from the PTOs. There are other issues associated with the principle of cost recovery which should also be addressed.

A first issue is whether administrative costs should be levied on all categories of users or, as in the case of special numbers, certain users should be exempted from these charges. The case again refers to residential and/or government users. In Finland, for instance, all subscribers will be subject to an annual fee for the number(s) they occupy and it is expected that this will cover more than half of the regulator's annual administrative expenses. The issue has also been raised by AUSTEL in respect of allocation charges for ordinary PSTN numbers issued to the public at large.

The Australian Fees Act of 1991 provides a framework of charging principles for the primary and secondary allocation of numbers for public telecommunication services. In particular, the Act provides for a fee to be set by the regulator and to be paid to the Australian Government for the primary or secondary allocation of an "ordinary" number. It is unclear whether the fee should recover AUSTEL's administrative costs and/or be equivalent to a tax for the use of a national resource. AUSTEL can act on behalf of the government and impose charges on carriers/service providers for the use of numbering space. In an updated document over its policy on charging for numbers, AUSTEL sets charging principles for the recovery of administrative costs of secondary and tertiary allocators. It recognises that carriers and service providers have considerable administrative costs when dealing with number searches, verification, and allocation procedures on behalf of their customers and that they should be able to recuperate these costs. With regard to its own administrative costs, AUSTEL states:

"This Policy may be amended in the future to incorporate provisions for AUSTEL to levy charges to recover its administrative costs, and to provide a mechanism for the Commonwealth to receive a proportion of charges levied by secondary and tertiary allocators to recover the value intrinsic in numbers." (AUSTEL, 1994a).

AUSTEL does not specify the level of charges that can be imposed by secondary allocators. Instead, it states that such charges *"must be related to the administrative costs"*. Such a practice increases the danger for service providers and end-users being charged unreasonably high prices for number

allocations. It may also allow secondary allocators to subsidise their operations out of the administrative charges imposed on their customers. A policing mechanism is necessary in this case to ensure that the charges imposed for the recovery of administrative expenses do not represent a new source of profit and that they should only be levied to ensure efficient allocation of numbers. AUSTEL's policy also calls for *"no restrictions on the number ranges for which secondary or tertiary allocators may levy charges for recovery of their administrative costs..."* (AUSTEL, 1994a). Therefore all users are subject to administrative charges irrespective of the type of service they use. However, special provisions can be arranged for certain categories of users, but this is up to the regulator to decide.

The case of AUSTEL is an example of a policy on charging principles as applied to secondary and tertiary allocators, that is to operators and service providers who make allocations to their users. The former are the primary allocators who should normally pay fees directly to the administrative authority for any block of numbers they reserve. The question that arises here is under which criteria should the industry, itself, contribute to the administration cost recovery. Should the same principles apply on an equal basis to all operators/service providers?

The discussion of this matter in the United States is based on the notion that any costs recovered should relate to the administrative burden placed on the regulator *"due to the type of resources used, requested or assigned to any entity or class of entities"* (Bellcore, 1994). In the United States case, it is assumed that an industry representative body oversees the development of NANP and that the industry should be responsible for sponsoring this new organisation. Such an approach depends on all industry entities reaching an agreement on the formula used for calculating prices. This is an approach worth considering, and which, when operating properly, may guarantee a fair and equitable funding mechanism.

Another issue that deserves attention is whether cost recovery principles should be applied to cover the costs of additional numbering related functions other than management and administration, as is the case in some OECD Member countries with spectrum fees. In Japan, for example, new spectrum fees are intended to pay for the creation of a transmitter database (OECD, 1993). A similar idea in the case of numbering would imply that numbering fees pay for the creation of databases for portable and/or personal numbers that could facilitate the introduction of personal numbering services. In the latter context, the user is assigned with a single personal number which can be accessed at any terminal of his choice, either mobile or any fixed network termination point regardless of location. From a technical point of view, OFTEL suggests that one way to accomplish portability across operators would be the creation of special databases carrying only portable numbers. Such a task would involve considerable technical and administrative costs. Given that portability is primarily enjoyed by corporate users and competitive service providers it seems only fair that they, at least, contribute to the costs of introducing portability. Parallel ideas could be proposed regarding the recovery of costs for the administration of a central Directory Information database, or the funding of research into the area of personal numbering.

Some countries may also consider using revenues from numbering fees for purposes which do not relate directly to any numbering activities. Such subsidisation practices should be avoided.

In general, the issue of pricing numbers is fairly complicated. Regulatory authorities in some OECD countries have just started considering the issue but no decision has been taken in terms of getting revenue from numbers.

2.4 Portability of numbers

The issue of number portability is currently being examined by regulators and technical experts in OECD countries, such as the United States, Canada, the United Kingdom, Australia and Finland. There are two basic reasons for such considerations. First, the evolution of such facilities as teleshopping, freephone, and premium rate services demonstrate an increasing reliance of sales and marketing activities on telecommunication services (OVUM, 1992). The numbers that are associated with the provision of such services are valuable to service providers and their customers and any change in their format may have significant impact on the volume of incoming traffic and may cause loss of revenue for businesses which are dependent on their telephone numbers. Second, the growth of competition in both networks and services has raised concerns about unequal opportunities for new entrants in a market, particularly since it is compulsory for customers who want to shift completely to another carrier/service provider to change their numbers. Market researchers in Europe have clearly indicated that the lack of number portability between operators has acted as a barrier to the development of competition because it restrains users from shifting to other operators/service providers.⁸ Prior to analysing the regulatory aspects of portability it is important to identify the following types of portability and the potential user demand.

a) *Types of portability*

i) *Location Portability*: This type of portability would enable users to maintain their telephone numbers when changing geographic location either in their local area (small distances) or even anywhere within a country. At present, most PTOs allow users to keep their current local numbers when they move within their local exchange area. In general, the provision of location portability becomes increasingly more difficult when users move outside their local charge areas. Moreover, other alternatives such as call forwarding facilities, are effective equivalents to location portability on fixed networks and are less expensive. Market researchers, however, in Australia and the United Kingdom have shown that location portability is not very popular among users, especially when they move long distances within their country. Retaining the existing geographic information of numbers and relating number prefixes with possible tariff information is a practice still favoured by users, even though some suggest current technology trends imply increasing independence between distance and call pricing.⁹

ii) *Service portability*: This type of portability would enable users to shift from one type of service to another, for example from a wireline to a wireless service, and keep their existing unique number. If both fixed and mobile network services are provided by the same operator, the interrogation of a single database which will contain all portable numbers can route the call accordingly. The case becomes increasingly complicated, however, in a competitive environment where more than one operator is involved. Today, a related version of this type of portability is available in the United States and the United Kingdom in the form of personal numbering services. AT&T in the United States provides a personal number service as a value-added, carrier specific service. It uses an intelligent network platform and assigns personal numbers to users that can follow them on any terminal of their choice as long as calls are routed through AT&T's switched network.¹⁰ Although the terminology varies a lot between different parts of the world, it is generally understood that Personal Number Services differ from Personal Communication Services. In the latter, calls are routed to a specific terminal which has "portable identity" (Tucker, 1994) while in personal numbering services numbers are assigned to persons and calls can be answered from whatever terminal users are near at the time of the call.

At present, there is no harmonisation among countries with regard to the numbering space allocated to personal numbers but revisions in national numbering schemes propose the allocation of special number ranges for this purpose.¹¹ Personal Numbering service is the first step to the future

UPT service provision where, according to the initial ITU definition, a user who has been assigned a personal number, can be accessed anywhere, on any terminal type, any network type, through any network operator.¹² When UPT becomes a reality potential UPT subscribers will be able to benefit from service portability and keep their most publicised numbers when they move to UPT.

iii) Operator portability: In a fully competitive environment, portability across operators would enable users to keep their existing numbers when changing carriers/service providers. For example, in the United Kingdom market where competition exists at the local level, users would be able to subscribe to the carrier of their choice without having to change their numbers, as is the practice today. The same would apply to any form of wireline or wireless network. At the moment it is possible for users to shift between different carriers on a call-by-call basis but this method is not without significant cost. Operator portability is the most desirable type of portability by users and the most frequently discussed among regulators.

In a 1989 document, OFTEL expressed the view that "public network operator portable numbers remove a potential major constraint on the development of competition in local telephony services. The scale of such a benefit is highly uncertain, but could run into several hundreds of millions of pounds per annum" (OFTEL, 1989). In 1991, the then Director General stated that transferability of numbers between operators is desirable in ensuring effective network competition and that the new national numbering scheme should provide for portability between operators and possibly between geographical locations.¹³ However, BT's licence required the completion of a cost/benefit analysis prior to the introduction of portability. Such a study was completed in the United Kingdom in March 1994 and, according to OFTEL, the results "*are both positive and robust on five of the six technical options considered*" for implementing operator portability (Sellers, 1994).¹⁴

Other countries such as Australia, Finland and Canada are also considering to introducing operator portability in the near future. In Australia, AUSTEL has established a specialist working group which studies the technical requirements for implementing operator portability in non-geographic services (mobile and special service numbers). It has also invited comments from all sides concerned over the best way to achieve portability within the same geographic area. In Finland a Study Group has been formed to study portability issues, with operator portability being at the top of the list, and first results are expected within 1994. Canada, following the United States practice, is currently working on the introduction of portability on freephone services.

The United States has been the first country to introduced operator portability. Since May 1993 operator portable numbers have become available in the United States in Freephone services.¹⁵ The Freephone market in the United States has seen exceptional growth estimated at 10 per cent annually (Mercury, 1993). AT&T alone states that it derives 40 per cent of its service revenues from toll free calling.¹⁶ With the advent of portability in 800 service the use of Freephone numbers increased by 300 per cent (Connors, 1994). Large users of 800 service are keen on the idea of being able to choose the carrier of their freephone number without having to change their numbers since these are their major sales tools. The results of a survey commissioned by MCI Communications prior to the introduction of 800 service portability showed that users believe that portability will increase competition and have a positive impact on costs and the availability of new 800 features. Large users were also more likely to conduct a review of their 800 service once portability becomes available.¹⁷ The United States industry, on the other hand, wishes to see further expansion of portability to other services and has requested NANPA to place number portability issues high on its agenda due to the time required to deal with all technical and economic issues involved. Individual carriers suggest that the industry should first gain experience with 800 number portability and perhaps cellular number portability before it implements portability at the local level.¹⁸

b) *Regulatory aspects of portability*

From a technical point of view, number portability implies significant routing changes to existing network architectures. For its implementation it requires either the use of identical information in all databases owned by individual operators/service providers, or high level of intelligence in the network so it can identify numbers from digit analysis and route calls to the correct carrier/service provider. It is also anticipated that further deployment of technologies, such as the Advanced Intelligent Network (AIN) and Signalling System No 7 (SS7) capabilities across the telecommunication industry, will facilitate the implementation of portability. The above options have been discussed with regard to operator portability, which is the one currently of most interest to regulators and users. Location and service portability, because of their nature, are seen more as cases which should be discussed between users and carriers/service providers (Bellcore, 1993a and OVUM, 1992). Moreover, the early implementation of personal number services by individual service providers indicates that the industry will play an important role in any future discussions over service portability issues. Discussions within the ITU-T Study Groups over the world-wide operation of personal numbering services, have shown that a truly global personal telecommunication service does not depend solely on regulatory and standardisation bodies but all industry participants.

The idea of introducing a single database shared among operators/service providers for the routing of calls has initiated lengthy discussions among regulators and telecommunication specialists. Apart from the technical constraints surrounding such a service, the main concern around this proposal has been twofold: first, decisions must be taken regarding the most appropriate body to undertake the implementation and administration of these databases; second, suitable regulatory actions need to be established so that they could guarantee a fair sharing of all the operation and administration costs associated with portability among the parties concerned.

With regard to the organisation of central databases, it has been proposed that national regulatory authorities, together with special study groups, should start preparing the ground for their implementation. The Australian Telecommunications User Group has gone even further by proposing the establishment of an independent national telecommunications database especially for the implementation of Freephone number portability, operator portability and for the future UPT services (AUSTEL, 1992a). On the other hand, concerns have been raised by OFTEL that the routing of calls to a common database shared by operators entails centralisation of activities when greater diversification and competition at all levels are being encouraged (OFTEL, 1993). Bellcore, in its second proposal on the future of numbering in WZ1, deals with portability issues and expresses its concerns over the implementation of shared databases and the burden of operation and administration costs. However, no particular guidelines have yet been drawn in that direction apart from the planning of "800"-number portability. A common view, shared by many business users in the United States, is that country-wide operator portability would probably cost "several hundred times" the cost of "800" databases and is further constrained by the slow steps in the deployment of the Intelligent Network.¹⁹

The high costs associated with implementing operator portability have led regulators to consider the case on the grounds of the costs involved versus the anticipated benefits. For example, new operators support the idea of portability because then users overcome the barrier of having to change their number and they can migrate easier from the incumbent. In that respect, operator portability serves as a stimulus to competition and assists in the development and growth of new entrants. On the other hand, a particular concern has been expressed over the quality of services using portable numbers. The latter has more to do with the extra time necessary for database enquiries, which leads to further delays in call set up time. It has also been argued that a possible drawback in operator portability is the fact that the old line may not be available for use at the time when the number is being transferee to another operator.²⁰

Measuring the costs and benefits of operator portability is definitely not an easy task. Measuring demand for operator portability, however, can be a first indicator of the kind of strategy that regulators could follow in that area. It has been suggested that most requirements for operator portability will come (a) from where competition at the local network exists, (b) from mobile operators, and (c) from customers of special services such as Freephone or premium rate services (OVUM, 1992). Without neglecting the importance of portability to residential users, most existing demand usually comes from large users who benefit the most by keeping their advertised numbers. Many of these users have been allocated large blocks of numbers or DDI numbers. An interesting issue for regulators to investigate is whether limited portability of large blocks of numbers may be preferable from a technical and economic point of view and should be considered as a first step in the introduction of full portability at a later stage. Another approach suggests that portability arrangements could take place together with the take up of a new service under the condition that certain numbers in designated ranges for services such as freephone, mobile and basic telephony, would be reserved for operator portability (OVUM, 1992).

In the end, purely technical problems in implementing portability will be up to the operators to solve. The costs, however, should be equally distributed among the parties involved. The option of using a market-based approach regarding the sharing of costs, so that the benefiting operator would have relatively higher financial obligations than the "losing" dominant operator, may be unfair for new entrants with small market shares. Another option may permit competitors to share these higher costs with the incumbent.

Overseeing a fair allocation of portability costs among operators is a key responsibility of number regulators. The latter are also responsible for overseeing any special charges imposed on end-users for the recovery of portability costs. These charges should normally reflect the real technical and administrative costs involved for the provision of the facility. Regulators in most countries where portability has been an issue have not yet decided on any concrete actions for policing the area. It is recognised that in location or service portability, and where services are provided by a single operator, transaction costs are limited and operation costs for implementing portability fall on the same company, since an operator makes use of its own databases. Thus, the regulator's role will be to define specific levels of charges for cost recovery of providing portability, or to approve the charges set by the operator on the basis that they express real market values.

In the case of operator portability, however, the situation is more complicated. The involvement of more operators make transaction costs higher and administrative costs more difficult to estimate. For example, "losing" operators may consider charging their ex-customers a compensation fee in order to cover some of their administrative expenses of number change. AUSTEL has also raised the issue that number allocation procedures should be arranged in such a way that they are able to accommodate the future implications of portability. AUSTEL uses the example of a company which has been allocated a block of numbers and has been charged for the value intrinsic of these numbers. If that company wants to change carrier, the same number block will then be associated with the new carrier. The point to make is that, with the advent of portability, regulatory mechanisms should guarantee fair accountability for the use of numbers by different operators so that no carrier would be charged for the use of numbers that are associated with the services of a competitor (AUSTEL, 1992c). OFTEL has found a way to deal with this problem in its draft Numbering Conventions. According to OFTEL:

"If a majority of numbers in an exchange area becomes transferred, the National Scheme Manager may with the agreement of the operators concerned reallocate to another operator the existing number range of that area and allocate a new range to the original operator for new numbers in that exchange area." (OFTEL, 1994).

A number of other issues evolve around portability and, certainly, more will come to the fore as soon as portability starts to be implemented on an industry-wide basis. Regulators should be prepared to effectively deal with any kind of obstruction caused by incumbent operators since portability is bound to reduce the latter's dominance in the market. Such mechanisms could be, for example, the setting of a specific time limit within which a carrier has to complete the re-direction of number after a user's request.

2.5 Directory services

a) *General issues*

Directory service provision is closely related to numbering issues since directories are the primary source of information of numbers for users. In a competitive telecommunication market, where more than one operator provides basic services to specified areas, it is normally expected that operators also provide their own directory enquiry services. Such services depend on a central database which is the same as that used by operators for the routing of calls. The building up of such a database is a costly procedure for new entrants, especially when they have not yet established themselves in the market. Moreover, the provision of more than one database may confuse customers who seek to get information in the easiest and most practical way. Thus, competitive carriers are more and more dependent on the incumbent operator for access to its directory database. This situation has led to considerable debates over how directory services should operate in a competitive market. The following issues have come to the fore:

- Who should own the information in directories?
- Who should hold and run the database for directory services?
- Under what terms and conditions should operators have access to and make use of that database?

b) *The United Kingdom experience*

In the United Kingdom, the issue of "equal access" to directory services has been brought forward by Mercury. According to Mercury, BT is acting in an unfair and discriminatory manner by providing no justification for its charges to competitors for the use of its database and by using different data entry processes for data entries of other operators, introducing further delay in updating information and putting additional expenses to the process (Mercury, 1993). Other operators have also expressed their concerns that the United Kingdom market for directory services is unduly restricted and that the provision of directories should not be associated with telephone subscriptions (Sellers, 1994).

OFTEL is well aware of the fact that new operators can fulfil their obligation of providing directory enquiry services only by having access to BT's directory database and is equally concerned about BT exercising proprietary rights over the use of that database. For these reasons, OFTEL has been examining the issue of directories in parallel with the numbering issue. Its approach, however, differs from that over the administration of numbers. Instead of proposing a take over the directory database and a central administration of the national directory by OFTEL it has adopted a more market-oriented approach.

OFTEL has the view that the operation of directory services includes less policy and more commercial issues to be considered, therefore, it strongly supports the idea of operators reaching

commercial agreements over the use of databases (Sellers, 1993). Another option favoured by OFTEL is the setting up of a separate database company which would provide unbranded "core" directories. In the United Kingdom, licensing of independent bodies to provide telephone directories using information supplied by operators is currently being considered. However, this option would involve modifications in BT's licence since its current status does not allow the provision of directory services by entities not involved in service provision (Sellers, 1994).²¹ Furthermore, such an approach entails a number of considerations around privacy issues, for both residential and business customers.

In March 1994, OFTEL announced its short and long term policy guidelines with regard to directory enquiries. These include (a) a formal examination of BT's charging practices for handling and accessing customer data, (b) a close investigation over the option of establishing a separate database company to provide numbering information, and (c) a consideration of the need to modify existing operation licences in order to ensure that any future actions in the directories area will be legally authorised.

CHAPTER 3

INTERNATIONAL AND REGIONAL REGULATORY SYSTEMS AND NUMBERING MANAGEMENT IN OECD MEMBER COUNTRIES

Numbering may be considered as a national resource, however, in order to standardise communication on a world-wide basis, compatibility of national numbering plans is necessary. Furthermore, the significant contribution of an integrated numbering plan to the promotion of trade and commerce among countries with common economic interests has been demonstrated in the case of the countries participating in the North American Numbering Plan (NANP).

The area served by the NANP covers what is described by ITU-T (previously CCITT) as World Zone 1 (WZ1). It includes almost all North America countries (i.e. the United States, Canada, Bermuda, the Caribbean) excluding Mexico. It is a common view among telecommunication-related bodies within WZ1 that NANP is a unique source and has contributed significantly to the growth of the North American telecommunication industry. NANP essentially provides common dialling patterns across countries who participate in the scheme, facilitating the development of cross-border networks and services with benefits for both users and service providers. Significantly, *Téléfonos de Mexico*, in its proposal for a long term numbering plan in Mexico, has considered participating in the NANP (Bellcore, 1993a).

The experience of NANP has influenced the European Commission to start working on the establishment of a common European Numbering Space (ENS) for services for which there is pan-European demand. The results of a recent study carried out for the Commission as part of its numbering policy initiatives, showed that the market potential exists for Europe-wide operation of services such as freephone, calling card and premium rate services. Service providers in Europe claim that the absence of pan-European networks has hindered the development of the services sector. If pan-European numbers for certain services were available today, service providers would have an immediate 15 per cent increase in their revenues. If pan-European numbers were to be offered in five years time then an increase of 50 per cent in business activity is estimated (O'Loughlin, 1994).

Co-ordination of numbering schemes at the regional and international level allows for the development of economies of scale in the telecommunication industry and therefore contributes significantly to the diffusion and promotion of new services. In that respect, numbering can be regarded as an "international resource" the administration of which is entrusted to supra-national regulatory bodies.

3.1 The International Telecommunication Union

Within the International Telecommunication Union, Study Group II within the Telecommunication Standardization Sector (ITU-T) is responsible for numbering issues within the context of its work on Network operation.

National numbering schemes tend to conform, to the maximum possible extent, with Recommendations approved by the ITU. Although Recommendations have no binding effect, they are widely adopted by Member countries and are accepted as applicable international standards. The following Recommendations have formed the basis of national numbering plans:

- Recommendation E.160 -- Definitions relating to national and international numbering plans;
- Recommendation E.161 -- Arrangements of figures, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network;
- Recommendation E.163 -- Numbering plan for the international telephone service;
- Recommendation E.164 -- Numbering plan for the ISDN era;
- Recommendation E.165 -- Timetable for co-ordinated implementation of the full capability of the numbering plan for the ISDN era.

Recent work within Study Group II has been focused on the definition of standards for new services that emerge and on the resolution of problems regarding their world-wide implementation. Much attention has already been given to the concept of Universal Personal Telecommunication service (UPT).

Although not yet officially defined by the ITU, UPT is envisaged as an integrated system of services, where personal numbering will be the core mechanism around which a number of essential and, later on, optional features will develop, such as call routing, call screening, call pick-up, support of data services etc. A personal number provides users the ability to be accessed at any location, irrespective of the terminal type. UPT in its wider context would also permit universal number portability across operators, so a user could be reached at any location world-wide through the operator of their choice. In March 1993, the World Telecommunication Standardization Conference in Helsinki approved Recommendation E.168 on the application of the E.164 numbering plan for UPT. This Recommendation, however, is currently under revision since a number of issues emerged which reflected the need for further consultation. In addition, ITU-T Study Group II is working on the service description and operational provisions for UPT (Rec F.851) and it is expected that a full Recommendation will be proposed for approval at the end of 1994. Discussions over UPT implementation highlight the fact that, as a service shifts from the national to the global level, a set of issues evolve that require further investigation. In the case of UPT, the major question is who could undertake the role of global number administrator. This remains an issue for future study within ITU-T.

Another area of research for Study Group II is the implementation of a Universal International Freephone Service (UIFS). The service is envisaged as the global version of the current nationally-based Freephone services and aims to provide customers with a single number that would be the same around the world. This would give companies a competitive advantage since it would permit them to advertise their products and be accessed by their customers from any part of the world through that single number. The description for the service is still in its development phase and the option of portability has to be examined.

Currently, work has concentrated on the structure of the UIFS number. Consensus on this issue is still lacking since the United States and Canada support a 7-digit fixed format, on the same lines as the one currently in use in WZ1, while the majority of the world favour a fixed 8-digit format that can guarantee a smooth and equitable passage from national IFS implementations to the UIFS. Across the world, Freephone services use variable number lengths ranging from 3 to 7 digits. A universal 8-digit

format could accommodate all existing national schemes by simply adding additional digits to the numbers.

The administration of a global operating Freephone service is another issue that needs to be considered. A first step has been made with the acceptance by the ITU to undertake the role of global administrator for UIFS and perform the central numbering registrar function. However, further work is necessary in order for the administrative procedures to be clearly defined. Undoubtedly, this will not be an easy task, given the major economic and political interests underlying this issue. Still, the ITU is the only body whose international authority and expertise can guarantee a fair and equitable global number administration for UIFS.

The 1993 World Telecommunication Standardization Conference identified numbering as a matter that requires urgent attention. A specific question regarding the applications of numbering and addressing plans for fixed and mobile services was allocated to Study Group II as an area of study for the period 1993-1996. The focus should be on the provision of numbering capacity *"for new applications and means to accommodate multiple carriers within a country when this affects international relationships"* (ITU-T, 4/1993). In parallel with the implementation of global service applications, a number of related projects are also being considered. These include, for example, a further review of Recommendation E.164; a redefinition of "country codes" in order to establish new eligibility criteria for country codes assignment; a study on the numbering requirement of multiple carriers/service providers operating within national boundaries; and the numbering and addressing implications stemming from the evolution of new services, such as Global Virtual Network Services.

3.2 European regulatory initiatives

The work of the European Commission (EC) in the area of numbering has concentrated on harmonisation for common access to certain services across Europe, as well as, on the shaping of national and European numbering policies.

In July 1991, the Council of Ministers adopted a Decision on the introduction of a single European emergency call number. According to the Decision, Member States are obliged to introduce the number 112 in their public telephone networks to provide for access to emergency services. This number will operate in parallel with other existing national emergency call numbers and Member States should conform with the Decision by 31 December 1996, at the latest.²²

A second initiative for Europe-wide harmonisation is the Council Decision of 11 May 1992 on the introduction of a standard international telephone access code. The Decision places a legal obligation on Member States to ensure that the code "00" is introduced in their public telephone networks as a standard international access code, no later than 31 December 1998.²³

With regard to the numbering responsibilities of Member States, the Council Directive on the application of Open Network Provision (ONP) to voice telephony includes an Article which covers numbering issues.²⁴ In particular, Article 21 provides for the following: a) the control of national telephone numbering plans by the national regulatory authorities and the allocation of numbers and number ranges through objective, transparent and non-discriminatory procedures; b) the publication of the main elements of the numbering plans by the regulatory authorities; and c) the promotion by the national regulatory authorities of activities related to the use of European numbering schemes for the provision of Europe-wide services.²⁵

The idea that the creation of a European Telephony Numbering Space (ETNS) would facilitate the development of Europe-wide applications is further endorsed in the Council Resolution on the promotion of Europe-wide co-operation on numbering of telecommunications services.²⁶ The Resolution recognises that in order for Europe-wide applications to develop there is a requirement for increased co-ordination in the management of numbering schemes at the European level. For this reason, it encourages the development of a pan-European framework of co-operation on numbering issues among national regulators, industry representatives and user groups. The European Committee for Telecommunications Regulatory Affairs (ECTRA) has been invited to undertake the role of general co-ordinator of the proposed scheme.

The ECTRA Project Team on numbering was set up in July 1992 and since then its work has been concentrated on the establishment of a regulatory framework around the requirements for harmonisation and standardisation in European numbering. ECTRA has set up a European Telecommunications Office (ETO) responsible for the day-to-day issues on European numbering. These will be handled by its numbering department ETO-N. The main responsibility of ETO-N, however, will be to bring numbering issues out of the closed standardisation bodies and to develop a wider discussion forum where all parties concerned will be able to participate on an equal basis and present their views. Open consultation of interested parties is regarded as an essential first step for a Europe-wide co-operation on numbering.

3.3 Numbering in the OECD Member countries

This section summarises the responses of most OECD countries to a questionnaire sent out in August 1993 to all Member countries in the context of the aimed Communications Outlook. Three questions related to numbering were included in the questionnaire. From the information collected it is apparent that the issue of efficient administration of numbers attracts increasing attention from regulators. The following questions were included in the questionnaire:

Who is the regulatory authority responsible for telephone numbering?

As indicated in **Figure 1**, the Ministry of Communications is usually the highest authority on telephone numbering in most countries. The Ministry, however has only plenary jurisdiction over numbering while the actual planning is being done by the incumbent PTO. Thus, the PTO still has the role of general numbering administrator whose proposals are subject to the Ministry for approval. Switzerland and the United States illustrate this case. Australia, Denmark, Finland, Italy, Norway, Portugal and Sweden have transferred numbering responsibilities from their PTOs to a regulatory authority, which, in most cases is a division of the Ministry. As stated in the ONP Directive for voice telephony, the countries of the European Union (EU) are called to transfer responsibilities over the development of telephone numbering plans to their national regulatory authorities in order to provide for fair competition. The above EU countries have already seem to be complied with the Directive whereas other countries, such as Spain, the Netherlands, Belgium and Greece waiting for the Directive to come into force before implementing it, in order to complete the passage. New Zealand, on the other hand, seems to have successfully adopted the "wider consensus" approach. The establishment of NZTNAG and the broadening of debates among service providers, user groups, and regulators has limited the formal regulatory role of the Ministry.

The second question was:

If competitive service provision is allowed can customers take telephone numbers with them if they change operator (e.g. transfer 800 numbers, cellular numbers?)

The responses of Member countries are presented in Annex 1 of the report. The question refers to the portability issue and attempts to measure the demand for this facility in OECD countries. Most countries have not responded to the question or have stated that the question is not relevant because there is only a single fixed-link carrier.

Figure 1. **Organisations responsible for the regulation of numbering in OECD countries**

Country	Authority
Australia	Australian Telecommunications Authority (AUSTEL)
Austria	Ministry of Public Economy and Transport
Belgium	Belgacom
Canada	Ministry of Industry
Denmark	National Telecom Agency
Finland	Telecommunications Administration Centre (TAC) Ministry of Transport and Communication
Germany	Federal Ministry of Posts and Telecommunications
Iceland	Ministry of Communications
Ireland	Department of Transport, Energy and Communications Telecommunications (Regulatory) Division
Italy	National Regulatory Authority (N.R.A.) -- PTT Ministry
Japan	Ministry of Posts and Telecommunications
Netherlands	Ministry of Transport and Public Works
New Zealand	Telecom, New Zealand Telecommunications Numbering Advisory Group (NZTNAG), Ministry of Commerce
Norway	Norwegian Telecommunications Regulatory Authority
Portugal	Instituto das Comunicações de Portugal
Spain	National Regulatory Authority (from 1998)
Sweden	National Telecom Agency (Telestyrelsen)
Switzerland	Federal Office for Communications (OFCOM), Telecommunications Operators
Turkey	Public Telecommunication Operator (PTT)
United Kingdom	OFTEL (from June 1994)
United States	Federal Communications Commission (jurisdiction), Bellcore (administration)

Source: OECD.

In Finland, Sweden, the United Kingdom, Canada and the United States, the issue of portability is under consideration, whereas in Norway, technical constraints are seen as major obstacles. However, it is anticipated that the portability issue, in most countries will rise in parallel with competition in basic service provision. Experiences from countries that have already dealt with the issue may be useful to other countries in terms of indicating the potential technical, regulatory, and administrative constraints of implementing portability.

The third question was:

Have there been any recent initiatives in the area of telephone numbering in your country?

Most countries seem to have been engaged in reforms in their numbering plans. In Australia, the Netherlands, Portugal, and the United Kingdom new plans have been finalised and changes are expected to occur within the next few years. Turkey, Norway and Finland have just had the experience of introducing new numbering arrangements, while Iceland and Belgium have recently harmonised their numbering schemes with the common EU initiatives regarding the introduction of a pan-European emergency call number and a single international access code. It is important to note that EFTA countries seek to conform with EU Directives for pan-European numbering practices.

In Canada and the United States, major changes are going to take place in 1995 in response to the need for long-term planning to accommodate the emergence of new trends in telecommunication services. A particular characteristic of the proposed numbering plan is the availability of 640 new "interchangeable" Numbering Plan Area (NPA) codes. The term NPA is equivalent to the ITU-T term National Destination Codes (NDC) and indicate a particular geographic area. Calls within that area are made by dialling the subscriber's 7-digit number which consists of a 3-digit Central Office (CO) code and the Station Number. For calls between NPAs subscribers should dial first the 3-digit NPA code followed by the subscriber's number. So far, there is no trunk prefix to indicate access to the long-distance network. Instead, the network distinguishes between a call within an NPA and a long-distance call by examining the second digit dialled. A second digit "0" or "1" indicates a long-distance call whereas digits "2" to "9" indicate CO code within the NPA. The new NANP provides for a trunk prefix 1 to be introduced for long-distance dialling so that CO codes and NPA codes can be used "interchangeably" and have, both, a second digit from "0" to "9". This expansion to a new format will give 640 additional NPA codes to be used in the NANP. Bellcore is currently investigating methods for efficient allocation of the new resources.

CHAPTER 4

CONCLUSIONS AND POLICY RECOMMENDATIONS

Many OECD Member countries are currently reviewing their numbering plans, or are in the process of doing so in the near future. The evolution of new services, on the one hand, calls for an expansion of national numbering plans in order for adequate resources to be created to accommodate new applications. The advent of competition, on the other, has given numbering important economic and commercial dimensions which have to be fully realised by policy-makers.

To a large extent, discussions over numbering management translate into who has control over access to number resources and, thus, who controls access to emerging new markets where revenue potentials are high (Hawkins, 1993). Numbers can become an anti-competitive tool in the hands of incumbent PTOs which would like to see their dominance extended in other profitable areas apart from basic telephone service provision. Experience from countries where competition has been introduced indicates that numbering is another area where monopoly structures can create problems to competitors. If policy initiatives had been taken earlier, many of the operational difficulties new entrants faced may have been overcome.

In countries where competition is just beginning to emerge, it will be all the more important to plan ahead and implement policy measures that would guarantee efficient allocation of number resources to all players in the market. From this standpoint, any changes made in numbering plans in order to increase their capacity and create sufficient space for new applications should be accompanied by appropriate changes in the methods of allocation of numbers. Numbering should not be seen as simply a technical matter, nor should it be assumed that an increase in number resources can assure their fair and efficient distribution. Service viability and expansion depend as much on numbering sufficiency as on the rules and procedures that govern allocation practices.

The notion of numbering as a national resource implies that these rules must be set by more than one actor in order for wider consensus to be reached. Given that each country is characterised by its own regulatory, industrial, and market conditions, the challenge is to define the appropriate model of numbering organisation that corresponds to a country's specific situation. There are, however, some common elements that can provide the basis for policy considerations on numbering.

4.1 Guidelines for the short term

The pressure for a shift to new forms of institutional organisation that would match with new objectives of equity and efficiency in numbering administration is now becoming apparent. Under these circumstances, a first requirement would be to move-away from the traditional operator-managed numbering schemes to new mechanisms that would allow wider involvement of all actors concerned.

The establishment of a consultative body that would represent all "users" of number resources, that is, industry representatives, operators/ service providers, major user groups, and government agencies

is seen as a prerequisite for any type of organisational change. Such a body could be an open forum for discussion of all numbering-related issues, such as the introduction of portability, the review of national numbering plan, and general competition issues that relate to numbering. Its establishment could compensate for both, the need for long-term planning of number resources and the fact that numbering should be treated as a national resource and, thus, wider consultation from all parties concerned is necessary.

Such a forum, however, should not underestimate the State's authority with regard to the use of a national resource. Here, the approaches taken by OECD Member countries differ as to, what stage of the numbering administration process is the most appropriate for the State to interfere. Undoubtedly, the State can play an important role in protecting consumers' interest and supervising the market. A mixture of wider public consensus on numbering issues with a more centralised administration provided by a State agency seems the most appropriate method for a fair and equitable organisation of the numbering space. The State, being the owner of the resource, could perform co-ordinating and regulatory functions, such as number allocation and provision of rights of use of numbers, while a separate consultative body could undertake all the planning and management functions.

The above regulatory and management functions, however, involve considerable administrative costs that should be shared equitably by all users of numbers. Several methods may be proposed for cost recovery:

- Impose a specific fee on operators/service providers and end-users, for their right to use part(s) of the resource. In the case of the former, the fee could take various forms depending on the kind of service provided (basic, cellular or other value-added service), the number of blocks that have been allocated to, or reserved by, a particular operator, the number of access codes it has been assigned, etc.
- Create a formula by which to calculate the amount operators/service providers have to pay for the numbers and access codes they have been allocated. The formula would correspond to the actual administrative burden placed on regulators after a specific request from a user. This will be a complicated method since it will involve qualitative, as well as, quantitative criteria for the approximation of a fee. For example, the final fee may depend on the hours spent to deal with a request, whether it can be satisfied immediately or under certain conditions, etc. but may not necessarily relate to the quantity of numbers requested (GTE, 1994).
- Other methods include market-based mechanisms such as a tender process or a public auction. Operators/service providers will be allocated numbers according to the amount of money they are willing to pay for a particular block. Other parameters, such as social welfare and the geographic coverage of a service, may also be considered in the case of a tender process. While such an approach will lead to maximisation of revenues for the State, it should not represent the best option to follow, since increase in Government revenues is not the objective. Moreover, the introduction of financial criteria in the allocation of ordinary numbers addressed to the wider public is opposite to the idea of numbers being a public resource, should have no price.
- For individual subscribers, the best approach is the imposition of a specific fee to all users who have been assigned numbers. Such a fee could be paid to the body of regulators and administrators either through the operator/service provider, or directly to the State agency and could be on an annual or a once-off basis.

Other methods may also be envisaged but they rely upon regulators to consider taking into account the particular conditions in a country and the profile of industry participants.

4.2 Guidelines for the long term

The commercial value of premium numbers has already been discussed. Their value can be justified first, by the competitive advantage they give to their owners due to their memorable structure (differential rent), and second, by the fact that they are scarce resources since there are not as many easily memorable numbers as there is demand (scarcity rent). Under these circumstances it would be logical to consider a system of market-based allocation of premium numbers, the benefits of which would be a better management and a more efficient allocation of this resource.

Such market mechanisms could be a tender process, an auction or a lottery, each having particular advantages and disadvantages:

- In a tender process, it is expected that the regulator defines the parameters to be respected by the candidates and awards the contract to the bidder that complies best with the pre-defined specifications. In the case of premium numbers such criteria could be, for example, the social welfare of the service where numbers are supposed to be used, its geographic coverage, the group of users to which the service is addressed, etc. These criteria may eliminate premium number allocation in certain types of services while favouring the development of others. A major disadvantage is that tender processes, in general, are susceptible to corruption. Thus, a well-established service provider may have to be discouraged from using other than legally-defined methods to win the bid.
- Auctions are considered as most appropriate mechanisms for the allocation of premium numbers and most efficient in terms of maximising revenues for the State. In an auction system, premium numbers would be allocated to those who can afford and are willing to pay the highest price. Big players would be particularly favoured by this mechanism, whereas for individual users and new entrants auction processes may increase barriers to access to premium numbers.
- Lotteries, on the other hand, provide equal chances to all candidates to have access to this resource. This approach does not necessarily lead to revenues for the State. It may, however, contribute to the creation of a secondary market where substantial capital gains could be derived from number trading between "winners" and "losers". Any intervention in order for the State to get a share of the revenues from the resale of numbers, is an issue that needs to be further considered.

Irrespective of the method chosen, any market based approach should be accompanied by a proper regulatory framework that would define the administrative procedures to be followed for the allocation of premium numbers. Yet, many matters need to be clarified, such as, for example, what mechanisms can guarantee access of individuals and social agencies to these numbers since these groups may lack the resources to participate in the competition. It is recognised that the issue of charging for premium numbers is complicated and difficult to regulate. Since policy-makers, however, are concerned with the efficient allocation of numbers, they should seriously consider this option.

ANNEX 1 RESPONSES FROM OECD MEMBER COUNTRIES

If competitive service provision is allowed can customers take telephone numbers with them if they change operator (e.g. transfer 800 numbers, cellular numbers)?

Australia	No response.
Austria	N.A. (not available/not applicable).
Belgium	Without object (not applicable).
Canada	Carriers offering interchange services plan to implement 800 number portability early in 1994.
Denmark	No response.
Finland	The matter is under consideration. In principal it is possible if all parties agree and it is technically possible, but in practice it is not likely.
France	<p>Following a public consultation on this issue by the DGPT at the end of 1993, it is foreseen that a consultative committee on numbering will be set up, chaired by the regulator and bringing together different operators, equipment representatives and user associations.</p> <p>This committee will be consulted on the procedures and criteria to be used to allocate numbering resources.</p> <p>After phase 3 of the French numbering plan has been put in place in the first part of 1996, the allocation of numbering resources will be entirely managed by the DGPT. It is envisaged that the following general principles will be observed irrespective of the type of resource (blocks of numbers either geographic or not, abbreviated numbers, special numbers).</p> <ul style="list-style-type: none">-- On demand by a potential operator, a pre-allocation of numbering resources is made by the DGPT.-- When an interconnection agreement has been made between a supplier and the public operator, France Telecom, the DGPT will make the final allocation of numbering resources which cannot be transferred to a third party.-- The beneficiary of an allocation must inform the DGPT yearly of the use of the resources allocated and this information will be made public.-- The DGPT can terminate an allocation in the event of bad management by the beneficiary operator (under utilisation, speculative usage, etc.).

Germany	No.
Greece	No response received in Regulatory part.
Iceland	There are no regulations covering this issue.
Ireland	No response.
Italy	No answer.
Japan	If customers change operators (including cellular provider) they cannot take telephone numbers with them.
Netherlands	Not applicable.
New Zealand	Other than to cellular markets, local competition has yet to occur. So Telecom issues all numbers (except for cellular where Bell South has its own numbers).
Norway	This is so far not regulated. To the extent that there exists any policy in this area the NRA is of the opinion that customers should be able to keep their numbers/addresses. However, this is mainly a question of technical capabilities.
Portugal	Not applicable in the fixed telephone service. Concerning the cellular services, it is not imposed.
Spain	No response.
Sweden	The question is currently under work within the NTA and discussions are held between the NTA and involved operators. However, a final decision the matter has not yet been taken (Jan. 1994).
Switzerland	Without objective (not applicable).
Turkey	N/A (not applicable/not available).
United Kingdom	No, however, a study is under way into the costs and benefits of the introduction of number portability into the fixed network. Results of the study are expected in early 1994.
United States	Sometimes customers can take 800 numbers with them if they change operator but they can't with most other numbers.

() indicates that the Regulatory part of the questionnaire, or part of it, had not been received by the time of preparation of this report.

Have there been any recent initiatives in the area of telephone numbering in your country? Please provide details.

Australia	No response.
Austria	N.A. (not available/not applicable).
Belgium	Operation of the pan-European emergency call number "112" in 1.1.93. Adoption from 1.1.94 of the prefix "0800" for the Freephone service.
Canada	- North American wide 800 number portability - A proposal is currently before the CRTC (Canadian Radio-Television and Telecommunications Commission) for 800 premises-based services. - Canada-United States review of the future of the North American Numbering plan.
Denmark	No response.
Finland	Finland was in 1990 divided into 12 telecommunications areas. This new division has caused changes in numbering. Due to competition in telephony prefixes for trunk network operators have been introduced and local telephone numbers have been redivided. Some national service numbers have also been changed according to the EC regulations.
France	See above response.
Germany	Common initiatives of EC Member States and CEPT members.
Greece	No response received in Regulatory part.
Iceland	Plans to change the numbering systems in 1995 have recently been published. These changes will include measures to change certain emergency and routing numbers to comply with EU plans.
Ireland	No response.
Italy	No.
Japan	None.
Netherlands	The Ministry of Transport will take over the management of number plans (which is now at PTT) to facilitate competition. The Ministry can provide numbering blocks to service providers (GSM-voice-data). This "take-over" process will be completed before 1998.
New Zealand	No response.

Norway	Norway has a fairly new national numbering plan. The transfer from the old to the new numbering plan has just been completed.
Portugal	At the moment a new project of numbering plan is being finalised.
Spain	No response.
Sweden	(Same response as in previous question).
Switzerland	Collaboration between OFCOM and PTT.
Turkey	Yes, it has recently been changed. It is a closed numbering scheme. Main features of the new numbering are 7 digit telephone numbers throughout the country, a single area code for each province with no need to use codes for calls within the same area, 3 digit area codes, access code (0) for long distance calls, access code (00) for international calls, special service numbers starting with 1.
United Kingdom	Oftel issued a consultative document "Numbering: Choices for the Future" in summer 1993, setting out proposals for the evolution of the United Kingdom Numbering Scheme (copy attached).
United States	Yes, there have been initiatives in numerous areas, including: interchangeable area codes, longer carrier identification codes, and assignment of numbers for personal services within the 500 code.

NOTES AND REFERENCES

1. CCITT, Recommendation E.164 -- Telephone Network and ISDN Operation, Numbering, Routing and Mobile Service -- Numbering Plan for the ISDN Era, Geneva 1991 (approved 23.8.1991).
2. According to the CCITT Recommendation E.164, the maximum number of digits for an international number (excluding the international dialling prefix) is currently 12. According to CCITT Recommendation E.165, this is to rise to maximum 15 after a specific time set by the Recommendation (Time T). This time is scheduled for 31 December 1996. By that time all systems handling international calls should be modified accordingly in order to adapt to the change.
3. According to Telecom New Zealand standard interconnection agreement, that percentage should be "9 per cent national toll market share or the Service Operator and all comparable interconnecting parties offering services similar to the Service Operator's Network Service (other than any member of the Telecom Group) have achieved an aggregate 13 percent national toll market share..." (Ministry of Commerce, New Zealand, 1991).
4. The situation is going to change in the United Kingdom. OFTEL will take over as the Numbering Administrator and the Director General of Telecommunications will be the authority responsible for taking decisions on numbering matters in accordance with the defined Numbering Conventions. OFTEL is in the process of undertaking complete responsibility from British Telecom (BT) over numbering administration and presented its draft Numbering Conventions in a consultative document issued in March 1994. Transfer of responsibilities from BT to OFTEL is expected to be completed during 1994.
5. Council of the European Communities (1993), Common Position adopted by the Council on 30 June 1993 with a view to adopting a Directive on the application of Open Network Provision (ONP) to voice telephony, Brussels, 1 July 1993.
6. The Federal Communications Commission (FCC) has asserted plenary jurisdiction over the administration of NANP within the United States. In Canada, the corresponding regulatory agency for numbering issues is the Ministry of Communications. In the Caribbean members of NANP, no special regulatory authorities exists with jurisdiction over NANP issues and governments of these countries participate in numbering related discussions whenever they find it appropriate.
7. Information derived by a Senior TAC official, 9 May 1994.
8. In the United Kingdom, for example, independent research undertaken by Hutchison Telecom, which has launched a personal communications network in the United Kingdom, and Southwestern Bell, partner in SBC Cable Communications UK, have shown that customers are deterred from shifting operators/service providers because of the unavoidable change in their numbers (Carey and Tucker, 1994).
9. According to OFTEL's market research, 84 per cent of the people questioned thought it was important to be able to know the cost of a particular call from its number prefix (OFTEL, 1993). AUSTEL's market research revealed that the percentage of customers wanting to keep their telephone numbers when changing locations was decreasing with the distance involved (only 32 per cent thought it was important to keep their numbers

when moving within the country). On the contrary, over two thirds of subscribers think it is important to be able to keep their telephone numbers when moving within their city (AUSTEL, 3/92).

10. The line must be presubscribed to AT&T or else the user has to dial AT&T's prefix (10 288) in order for his call to be completed to the right party. At the moment, the LEC as soon as it recognises the "700" code it routes the call to AT&T's Easyreach service platform. The call routing data is obtained from the system's database and the call is completed over AT&T's network. The issue of access routing of non-geographic services, i.e. whether the call should be routed to the service provider or to the caller's presubscribed carrier, is of major concern and is currently being worked by an industry committee (Hirsch, 1994).
11. The original request of AT&T for the assignment of "700" code to provide personal numbering services initiated a process of assignment guidelines for personal numbers by Bellcore in August 1993. The FCC, however, ruled Bellcore not to proceed with its plans. Its ruling was based more on the conflicting political, commercial and regulatory problems that such project would involve rather than on the technical constraints of number allocation planning. Meanwhile, AT&T was using the "700" service access code for its service.
12. ITU-T Recommendation E.168 (previously CCITT Recommendation) -- Application of E.164 Numbering Plan for UPT, March 1993 (under revision).
13. OFTEL (1991), White Paper, *Competition and Choice: Telecommunications Policy for the 1990s*.
14. It should be noted that the only portability option currently considered by OFTEL is that for telephony services delivered to a fixed address (the subscriber does not change location).
15. The North American Numbering Plan (NANP) administrator, Bellcore, had assigned 800-NXX blocks to interested carriers in order to stimulate competition. Each block contains 10,000 numbers but one NXX code could be allocated to a carrier if it presented a fill level of 70 per cent, that is 7000 numbers required, allowing thus greater numbering flexibility for new carriers to establish their service. Each of these numbers would be eventually "sold" to customers by the carrier. However, as the market for freephone services was expanding, this approach had its limitations. Namely: (a) numbers were used inefficiently, (b) customers often could not get the number they wanted if the carrier they were using had been assigned a different code, and (c) customers could not change service providers without changing their numbers. As a result, Bellcore initiated actions to implement 800 number portability. Bellcore's plan included an intervening time until each geographical area had its own database of 800 number service. The database has the ability to identify a 10-digit carrier function from memory rather than use a 6-digit translation to route the calls to the correct carrier. At that stage the technical capability exists for users to change carriers within the territory served by that database. (Connors, 1994, and Bellcore, 1985).
16. "Sometimes a Great Notion", Editorial Article, *Communications Week International*, 7 February, 1994.
17. Source: *Telecommunication Reports*, December 21, 1992. In practice, this has become true. For example, in February 1994, Computer Associates International, Inc. moved its 800 number traffic to MCI from AT&T as a result of portability.
18. "Local Number Portability", *Telecommunication Reports*, January 4, 1993.
19. View expressed by Southern New England Telephone Company Co. and quoted in *Telecommunications Reports*, January 4, 1993.
20. Opinion expressed by the Australian & Overseas Telecommunications Corporation in AUSTEL's Summary Report of Submissions from "Your Number's Up", Submission 36.

21. An interesting case was reported in the press in April 1994, where a small American database company was attempting to break BT's monopoly in directory information services. The company has downloaded the entire British telephone directory onto a Compact Disk (CD) which it sells for only £50. A similar, but less sophisticated, disk produced by BT costs £1,000. BT has taken legal action to prevent the sale of the CD in the United Kingdom. BT's view is that "... we own the telephone numbers information and we will defend that copyright rigorously in the High Court". The outcome of the appeal process was not yet known by the time of preparation of this report (Sunday Times, April 18, 1994).
22. Council Decision of 29 July 1991 on the introduction of a single European emergency call number (91/396/EEC; OJ L217/31, 06.08.91).
23. Council Decision of 11 May 1992 on the introduction of a standard international telephone access code in the Community (92/264/EEC; OJ L137/21, 20.05.92).
24. Proposal for a Council Directive on the application of Open Network Provision (ONP) to voice telephony, OJ C 147, 27.5.1993; COM(93)182. Common position formally adopted by the Council on 30 June 1993.
25. The list of services included in this category is presented in Annex III of the Directive and refers to pan-European Freephone and Premium rate services, call transfer, automatic reverse charging service facilities, calling line identification, and access to operator and directory enquiry services in other Member States.
26. Council Resolution of 19 November 1992 on the promotion of Europe-wide co-operation on numbering of telecommunications services (92/C 318/02; OJ C318/2, 04.12.92).

BIBLIOGRAPHY

- AUSTEL (1991), *Your Number's Up -- A Discussion Paper on Changing Telecommunications Numbering in Australia*, Melbourne, December.
- AUSTEL (1992a), *Report of Main Findings -- Customer Opinion on Telecommunications Numbering and Evaluation of Options for a New National Numbering Plan*, Melbourne, March.
- AUSTEL (1992b), *A Summary Report of Submissions from "Your Number's Up -- a Discussion Paper on Changing Telecommunication Numbering in Australia, Melbourne"*, March.
- AUSTEL (1992c), *Australia's Telephone Number Plan -- A discussion Paper on Numbering Administration Issues*, Melbourne, October.
- AUSTEL (1993), *Australia's Telephone Number Plan -- The National Numbering Plan*, Melbourne, April.
- AUSTEL (1994a), *National Numbering Plan -- Policy on Charging for Numbers*, Melbourne, January.
- AUSTEL (1994b), *National Numbering Plan -- Policy on Rights of Use of Numbers*, Melbourne, April.
- BELLCORE (1993a), *North American Numbering Plan Administrator's Proposal on the Future of Numbering in WZ1*, Second Edition, New Jersey, January.
- BELLCORE (1993b), "Status of Numbering in the NANP Served Area, 12/31/93", document distributed in the Commed Conference Numbering for Competition, London, 14 -15 April 1994.
- BELLCORE (1994), *Future of Numbering Forum 5 (FNF5) -- Draft Meeting Minutes*, 11 April 1994.
- CARTER, S.G., Coopers & Lybrand Deloitte, F. Arnold (1992), *Report on the introduction of a European Area Code*, prepared for the Commission of the European Communities, January.
- CCITT (1988), *Recommendation E.163, Numbering Plan for the International Telephone Service, in Telephone Network and ISDN -- Operation, Numbering, Routing and Mobile Service, Blue Book, Vol. II, Fascicle II.2*, Geneva.
- CCITT (1989), *Recommendation E.164, Numbering Plan for the ISDN Era, in Telephone Network and ISDN -- Operation, Numbering, Routing and Mobile Service, Blue Book, Vol. II, Fascicle II.2*, Geneva.
- CCITT (1989), *Recommendation E.165, Timetable for Co-ordinated Implementation of the Full Capability of the Numbering Plan for the ISDN Era, in Telephone Network and ISDN -- Operation, Numbering, Routing and Mobile Service, Blue Book, Vol. II, Fascicle II.2*, Geneva.
- Commission of the European Communities (1991), *Council Decision of 29 July 1991 on the Introduction of a single European Emergency Call Number*, 91/396/EEC; OJ L217/31, 6 August 1991.
- Commission of the European Communities (1992a), *Council Decision of 11 May 1992 on the Introduction of a Standard International Telephone Access Code in the Community*, 92/264/EEC; OJ L137/21, 20 May 1992.

- Commission of the European Communities (1992b), Council Resolution of 19 November 1992 on the promotion of Europe-wide co-operation on numbering of telecommunications services, 92/C 318/02; OJ C318/2, 4 December 1992).
- CONNERS, R. (1994), "North American Numbering for Competition and Technical Change", paper presented at the Commed Conference *Numbering for Competition*, London, 14-15 April.
- Council of the European Communities (1993), Common Position Adopted by the Council on 30 June 1993 with a View to Adopting a Directive on the Application of Open Network Provision (ONP) to Voice Telephony.
- Direction Générale des Postes et Télécommunications (1993), *Numérotation Téléphonique: Quelles évolutions pour le futur?*, Document Consultatif, Paris, November.
- EVAGORA, A. (1991), "Success May Lie in the Numbers", *Communications Week International*, 15 July.
- GTE (1994), "WZ1 Numbering Organizational Funding Alternatives" included in the Future of Numbering Forum 5 (FNF5) -- Draft Meeting Minutes, 11 April 1994.
- HARRINGTON, D. (1993), "The Numbering Issue", paper presented at the CommEd Conference on Numbering, London, 24 June.
- HAWKINS, R. (1993), "Beyond the Year 2000 -- Numbering for UPT", paper presented at the CommEd Conference, London, 24 June.
- HIRSCH, R. (1994) "Personal Numbering -- AT&T's Service", paper presented at the Commed Conference *Numbering for Competition*, London, 14-15 April.
- HIRST, D. (1991) "European Telephone Numbering: The Beginning of the End of PTT Nationalism?" paper presented at the European Cordless Communications Conference, Paris, 27 June.
- ITU-T (1993), Recommendation E.168, Application E.164 Numbering Plan for UPT, Geneva.
- KANERVISTO, J. (1994), "Numbering in a Multi-operator Environment", paper presented at the Commed Conference *Numbering for Competition*, London, 14-15 April.
- KOOLEN, L. (1994) "The European Commission's Plans" paper presented at the Commed Conference *Numbering for Competition*, London, 14-15 April.
- MERCURY (1993), Statement by MERCURY COMMUNICATIONS LIMITED, presented at PITCOM, March.
- Ministry of Commerce (New Zealand) (1991), *Telecommunications Numbering in New Zealand*, First Report, November.
- Ministry of Commerce (New Zealand) (1992), *Telecommunications Numbering In New Zealand: An Issues Paper*, Second Report, November.
- New Zealand Telecommunications Numbering Advisory Group (NZTNAG) (1994), New Zealand Telecommunications Numbering Advisory Group Activities, mimeo.
- NUITJEN, J. (1994), "The Work of ECTRA -- Europe-wide Numbering Co-operation and Numbering Spaces", paper presented at the Commed Conference *Numbering for Competition*, London, 14-15 April.

- OECD (1993), *The Economics of Radio Frequency Allocation*, OECD, Paris.
- OFTEL (1991), *Statement -- Numbering for Telephony Services in the United Kingdom*, London, September.
- OFTEL (1993a), *Press Notice -- OFTEL Publishes Consultative Document on Future Numbering Option*, London, June.
- OFTEL (1993b), *Numbering: Choices for the Future*, Consultative Document, London, June
- OFTEL (1994), *Numbering Conventions and Specified Numbering Scheme*, A Consultative Document, London, March.
- O'LOUGHLIN Mary Ann and S. Sharock (1994), *Potential Opportunities Afforded by a New European Telephony Numbering Space*, ETNS Final Report.
- OVUM (1992), *A Study on a Telecommunications Numbering Policy for the European Community*, Final Report to the European Commission, Volume 1: Main Report, June.
- OVUM (1993), *Personal Numbering Services -- The Business Opportunity for UPT*, Part F: Regulatory Issues for UPT, London.
- SELLERS (1993), "Who's Got Your Number? -- Control of Telephone Numbering and Directories" paper presented at PITCOM, March
- SELLERS, P. (1994), "UK Policies and Plans" paper presented at the CommEd Conference *Numbering for Competition*, London, 14-15 April.
- Sunday Times, April 18, 1994.
- Telecommunications Report, 21 December 1992.
- Telecommunications Reports, 4 January 1993.
- Telecommunications Reports, 18 January 18 1993.
- Telecommunications Reports, February 15, 1993.
- Telecommunications Reports, 14 February 1994.
- TUCKER, C. (1994), "Advanced Mobile Services" paper presented at the CommEd Conference *Numbering for Competition*, London, 14-15 April.
- "The Administration of North American Numbering Plan Demands Careful Scrutiny and Prompt Action", Feature Article, *Trends in Communications Policy*, Vol. 18, No 2, February 1993.