Antelope Consulting

Numbering for convergence in Colombia

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El presente Informe refleja la opinión de la autora y no necesariamente la de la Unión Internacional de Telecomunicaciones.

Contents

1 Scope

1.1 Objectives

This consultancy report has been produced for the Comisión de Regulación de Telecomunicaciones (CRT) in Colombia and financed by the International Telecommunication Union (ITU). Its aim is to recommend options for the numbering plan of Colombia that:

- Accommodate convergence, extra competition and geographic demand.
- Provide ample capacity for existing and future non-geographic services.
- Conform with the current laws and regulations as far as possible.
- Minimise the impacts of any transition on operators and users.
- Help users (usually with tariff transparency, simplicity, consistency, and short numbers).
- Are guided by international good practice.

We expand on some of these criteria in Section 1.3 and Section 1.4.

1.2 Sources

The report draws on information and views gathered from:

- CRT and industry participants in Colombia. Organisations represented at meetings during a visit to CRT from 22 to 25 August 2006 are listed in Annex A. Further meetings occurred during a visit to CRT from 17 to 24 November 2006.
- Replies to a questionnaire sent to industry participants in Colombia.
- Findings from a survey of numbering practices in other Latin American countries, sent to Regulatel contacts. The findings, with some details provided by the consultants, are summarised in Annex B.
- The background knowledge and research of the consultants[1].

The report is largely about numbering, not general policies for telecommunications development. Carrier selection and number portability are matters for competition policy. The report discusses the implications for numbering of carrier selection and number portability, but it does not consider competition policy in detail. Final decisions about numbering may need to await decisions about competition policy.

1.3 User preferences

Colombia (along with other Latin American countries) has been influenced by both North American and European practices, though these are not always compatible. Figure 1 compares some practices of the North American Numbering Plan (NANP) with those elsewhere. Our survey of Latin American countries shows a mixture of these practices together with other variants (such as call-by-call carrier selection codes using 0XY, as found in Colombia and Brazil).

[1] Throughout this report, for more information on numbering developments see *World Numbering Developments* (Antelope Consulting, May 2005) at http://www.antelope.org.uk/numbering/World_numbering_developments.pdf by the authors of this report.

Feature	NANP numbering	International numbering[2]
National prefix (in countries making distinctions between national and local dialling)	1	0
International prefix	011	00
Short codes	211, 311, 411, 511, 611, 711, 811 and 911[3]	1xx and so on (100 – 100 000 of these)
Emergency calling code	911	112 (EU and GSM)
Directory enquiries codes and ranges	555 xxxx	118 (EU)
Live operator codes	0	1xx
Carrier selection codes	10x xxxx	1xxx
Use of 0	Live operator code	National prefix
Uniformity	Complete (1 xxx xxx xxxx)	Variable but increasing
Geographic relief methods	Area splits and overlays	Extra digits and code changes
Mobile number ranges	Mainly using geographic codes	Distinctive
Specially tariffed number ranges	456, 500, 555, 800, 866, 877, 888 and 900[4]	Distinctive
Distinctions between national and local dialling	Disappearing in Canada and the US through area splits and overlays	Disappearing in smaller countries through extra digits and code changes

Figure 1 Comparison of NANP and general international numbering practices

Where there is a numbering choice to be made in Colombia (such as the choice of which short codes to allocate to which purposes), we suggest that attention is paid firstly to what is convenient for citizens of Colombia and secondly to what is familiar to foreign visitors, who may of course come from North America, Europe, the Pacific Rim or neighbouring parts of Latin America. To assess what is best for users in Colombia, we are reliant on views expressed by CRT and companies, combined with our background knowledge of user behaviour elsewhere in the world.

People in Colombia at all income levels are making significant use of the phone. Average monthly usage for users at the lowest of the six income strata in 2004 was 257 minutes, which is almost half of the average at the highest income level (546 minutes)[5]. Though exact statistics are not available, people in lower income groups are more likely to be poorly

[2] These characteristics are not all required by international or regional recommendations but are widespread among countries that do not use the NANP.

[3] Because these codes are scarce, they tend to be reserved for important services. Even so, they are not all available wherever the NANP is used. For a description of a service that tells callers about social support organisations, for example, see http://www.211.org/.

[4] The NANP treats all codes having identical second and third significant digits as "easily recognisable" and potentially usable for special purposes (though some are not yet used).

[5] See the useful CRT report *Developments in the Telecommunication Sector* (ITU, June 2006) at http://www.itu.int/osg/spu/ni/voice/documents/Background/Colombian_TC_sector.pdf.

educated and to prefer fixed services to mobile services[6]. We conclude that it is particularly important to keep dialling patterns from fixed phones as simple as possible, and to keep any changes to numbering as easy to explain as possible, to help people who could be confused.

There is a strong preference among users for short dialling sequences, which are known to be less prone to errors[7]. Also, one operator in Colombia commented that many people avoid using 01 800 xxx xxxx numbers if they can dial short codes instead.

All fixed access network operators contributing to this study report that over 80% of calls originating on their networks are dialled with 7 digits or less, without prefixes. By contrast, mobile access network operators say that over 90% of calls originating on their networks are mobile-to-mobile calls, dialled with 10 digits (or with 12 digits, if they include the 03 prefix for internetwork calls)[8].

Tariffs are made more transparent if services that have very different tariffs differ recognisably in their numbers (and preferably in the first few digits of their numbers). Thus distinctiveness is important, at least for non-geographic numbering.

1.4 Current challenges

The national numbering plan of Colombia is laid out in legal instruments that are listed in Annex C. The foundation document is Decree 25 of 2002, which has been only amended slightly since 2002. Up-to-date block allocations are shown on a website about the industry[9]. They are also summarised conveniently on the ITU website[10].

The plan changes in Decree 25 of 2002 were to be implemented in two phases. The first phase would make mobile and non-geographic numbers have 10 digits; it occurred in 2002. The second phase would make geographic numbers have 10 digits; it was postponed from 2004 by Decree 2455 of 2003 until required by the Ministry of Communications.

There could be shortages of geographic numbers in Bogotá. As several access network operators are active there, more number blocks (and therefore less efficient utilisations of number blocks) are likely to be needed and to make any shortage of numbers worse.

There are three long distance national and international operators, associated with the three main fixed access network operators. Fixed and mobile access network operators are

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[6] This is partly because of the Colombian system of subsidising fixed lines for low income groups, and partly because of limited roll-out of mobile coverage to rural areas where people are predominantly poor. However, the overall balance will change, as there is fixed-mobile substitution and as mobile coverage is expanding to areas where there is no fixed coverage.

[7] See "The expanding telephone number Part 1: Keying briefly presented multiple-digit numbers", *Behaviour and Information Technology*, volume 21, part 1, January 2002, pages 27-38 (by Knut Nordby and others) at http://taylorandfrancis.metapress.com/app/home/contribution.asp?wasp=4f41f190a9a44170b5257d42e55d69b9&referrer=parent&backto=issue,3,7;journal,20,55;linkingpublicationresults,1:100652,1 and "The expanding telephone number Part 2: Age variations in immediate memory for multiple-digit numbers", *Behaviour and Information Technology*, volume 21, part 1, January 2002, pages 39-45 (by Ruth Raanaas and others) at http://taylorandfrancis.metapress.com/app/home/contribution.asp?wasp=4f41f190a9a44170b5257d42e55d69b9&referrer=parent&backto=issue,4,7;journal,20,55;linkingpublicationresults,1:100652,1.

[8] The high proportions of intranetwork calls may be due to high long distance tariffs. However, we have also seen evidence of high failure rates for internetwork calls, which suggests that the interconnection provided is inadequate or defective.

[9] See http://www.siust.gov.co/siustpru.

[10] See *National Numbering Plan* (ITU, January 2006) at http://www.itu.int/itudoc/itu-t/number/c/col/79971.html. This has been used for the block allocation data analysed and presented in this report.

obliged to provide ‘multi-access’ to these three operators; ‘multi-access' is implemented by call-by-call selection, using dialling prefixes 05, 07 and 09, followed by the National Significant Number (NSN), for national calls and 005, 007, and 009, followed by the International Significant Number (ISN), for international calls[11]. There is no carrier preselection.

A Free Trade Agreement (FTA) with the United States (US) is thought likely to be signed. Relevant extracts from a recent draft of this are attached in Annex D. There is a commitment to opening the market to new long distance national and international competitors from August 2007, with dialling parity between existing and new competitors. There is also a commitment to introduce number portability, subject to economic feasibility and with exceptions for rural areas. More generally, the FTA will guarantee all competitors fair and equal access to numbering resources.

Market opening presents challenges to:

- Ensure fair access for all competitors to the scarce resource of geographic numbers, especially in Bogotá. The plan and migration for geographic numbering are discussed in Section 2.
- Develop customer understanding of, and confidence in, non-geographic services. Numbering aspects of this are discussed in Section 3.
- Determine the treatment of Voice Over IP (VOIP) and other new services that display ‘convergence’. Numbering aspects of this are discussed in Section 4.
- Ensure fair access for all competitors to the scarce resource of short codes, including 1XY. Ways of doing this are discussed in Section 5.
- Adapt the multi-access system based on carrier selection codes of the form 0X so as to be fair to all competitors. Ways of doing this are discussed in Section 6.
- Enable competition in directory enquiry services. Numbering aspects of this are discussed in Section 7.
- Ensure orderly use of short codes on mobile phones. Overall implications this are discussed in Section 8.

The report also considers:

- Number portability, in Section 9.
- ENUM, in Section 10.
- Cross-border aspects of numbering regulation, in Section 11.
- Practices in number allocation, in Section 12.

The recommendations are summarised in Section 13. In making these recommendations we have paid attention to the current legal and regulatory framework in Colombia but we have not felt strictly tied to it, because sometimes the benefits of changing it may outweigh the costs.

[11] An NSN is a National Destination Code (NDC) followed by a Subscriber Number (SN); an ISN is a Country Code (CC) followed by an NSN. ITU refers to an NSN as an ‘N(S)N’.

2 Geographic numbers

2.1 Experience in other countries

During the past 10 to 15 years, many countries have changed their geographic numbering plans. Their objectives and approaches have included:

- Clearing geographic numbering away from part of the numbering plan to make space for distinctive numbering of new non-geographic services, including mobile. This is typically done by prefixing a digit to some or all existing geographic National Destination Codes (NDCs), so that they then occupy only 10% of the numbering space. Often the prefix is a low digit, not 8 or 9, say[12]. This approach was used, for example, in the UK (using the prefix 1), Venezuela (using the prefix 2) and Argentina (using the prefixes 1, 2 and 3).
- Simplifying numbering plans, often combining many small NDCs into fewer, larger NDCs. This is in keeping with network changes that move towards fewer exchanges and less distance-dependent charging. In the Netherlands, for example, there were formerly many small areas with 4-digit NDCs and 5-digit subscriber numbers that were then grouped together in a natural way into larger areas with 3-digit NDCs and 6-digit subscriber numbers.
- Making dialling procedures more uniform and therefore easier for callers. This often entails standardising code and subscriber number lengths and sometimes entails withdrawing the possibility of local dialling (the dialling of subscriber numbers without NDCs). Withdrawing the possibility of local dialling, also known as 'closing the plan', requires more digits for local calls and has been more popular in plans with shorter NSN lengths (of 7 or 8 digits). In the UK and the Netherlands, along with most Latin American countries, local dialling has been kept, but in Italy and Greece it has been discarded (possibly because dialling is then the same from fixed and mobile phones). Unless numbering ranges are expected to acquire many new callers, keeping them familiar is more important than making them uniform.
- Providing more capacity for growth in geographic numbering, especially in cities. In North America this is done by area splits or code overlays, so 7-digit subscriber numbers are preserved but local dialling is reduced or lost in those areas. Elsewhere in the world, including some major Latin American countries, 8-digit subscriber numbers have been introduced in large cities; for example, London, Rome, Tokyo, Buenos Aires, Mexico City, Shanghai, Beijing and Seoul all now have 8-digit subscriber numbers while smaller cities in the same countries have 7-digit subscriber numbers. (Paris, Rio de Janeiro, Sao Paulo and Sydney have 8-digit subscriber numbers in common with the rest of their respective countries.) Closing the plan is also used in some countries to enhance geographic capacity in cities.

[12] However this is not always so: in Spain, for example, the old trunk prefix 9 was absorbed into the front of all numbers so that after the numbering change all numbers (geographic or not) started with 9.

2.2 The current position in Colombia

2.2.1 Utilisation

Colombia currently has 7 geographic NDCs. Each geographic NDC has 1 digit, and in each geographic NDC area each subscriber number has 7 digits. There is a close, though not exact, match between NDC areas and groups of Departments.

Figure 2 summarises numbering capacity and demographics by Department[13].

Department name	Department abbreviation	Population	Main NDC	Numbers allocated in main NDC	Numbers allocated in other NDCs[14]	Numbers allocated in all NDCs	Numbers used	Numbers used as proportion of numbers allocated
Cundinamarca	CUN	2 349 578	1	428 080	4 528	432 608	347 260	80%
Distrito Capital	D.C.	7 117 984	1	5 228 101	2 700	5 230 801	3 158 743	60%
Cauca	CCA	1 363 054	2	148 100	136	148 236	102 096	69%
Nariño	NAR	1 775 139	2	147 400	12	147 412	106 508	72%
Valle del Cauca	VAL	4 524 678	2	2 589 600	11	2 589 611	908 132	89%
Antioquia	ANT	5 750 478	4	4 026 250	300	4 026 550	1 391 769	35%
Choco	CHO	413 173	4	30 000	565	30 565	23 985	78%
Córdoba	COR	1 392 905	4	220 231	0	220 231	144 690	66%
Atlántico	ATL	2 365 663	5	664 251	5	664 256	394 018	59%
Bolívar	BOL	2 229 967	5	341 232	2 238	343 470	174 102	51%
Cesar	CES	1 050 303	5	87 700	907	88 607	76 872	87%
La Guajira	GJR	524 619	5	64 010	11	64 021	38 638	60%
Magdalena	MAG	1 403 318	5	127 300	34	127 334	87 283	69%
Sucre	SUC	868 648	5	84 800	8	84 808	71 585	84%
Caldas	CDS	1 170 187	6	318 300	34	318 334	201 993	63%
Quindio	QUI	613 375	6	149 500	0	149 500	109 862	73%
Risaralda	RIS	1 024 362	6	317 300	0	317 300	234 459	74%
Arauca	ARC	282 302	7	24 400	11	24 411	19 085	78%
Norte de Santander	N.S.	1 493 932	7	201 200	316	201 516	148 956	74%
Santander	SDR	2 085 084	7	586 254	4	586 258	379 426	65%
Amazonas	AMZ	80 360	8	5 643	0	5 643	4 373	77%
Boyacá	BOY	1 411 239	8	227 817	400	228 217	149 028	65%

[13] In this report Distrito Capital is treated as a Department.

[14] These allocations outside the main NDC appear to relate in part to places near Department boundaries (which for historic reasons are numbered as part of the adjacent Department), and in part to public phones and social telephony initiatives. In total they amount to under 1% of allocated geographic numbering capacity.

Department name	Department abbreviation	Population	Main NDC	Numbers allocated in main NDC	Numbers allocated in other NDCs[14]	Numbers allocated in all NDCs	Numbers used	Numbers used as proportion of numbers allocated
Caquetá	CAQ	463 333	8	42 835	0	42 835	32 176	75%
Casanare	CAS	325 713	8	51 900	0	51 900	35 384	68%
Guainía	GNA	43 314	8	1 719	0	1 719	1 214	71%
Guaviare	GVR	133 236	8	3 422	0	3 422	3 208	94%
Huila	HUI	994 218	8	162 505	0	162 505	141 367	87%
Meta	MET	771 089	8	189 533	0	189 533	137 820	73%
Putumayo	PUT	378 483	8	22 032	0	22 032	18 480	84%
San Andrés y Providencia[15]	SND	83 491	8	45 504	0	15 504	13 421	29%
Tolima	TOL	1 312 972	8	297 907	1 000	298 907	204 958	69%
Vichada	VCH	97 276	8	2 016	0	2 016	1304	65%
Vaupés	VPS	33 152	8	1 632	0	1 632	698	43%

Figure 2 Population and number utilisation by Department

Figure 2 demonstrates that:

- There is high utilisation of allocated numbering capacity throughout the country (over 50% in most Departments and over 75% in many).
- Allocated capacity is well below one number per head of population except in the three Departments containing the biggest urban areas (Distrito Capital, Valle del Cauca and Antioquia). These are also the only three Departments with over 1 million allocated numbering capacity (which is the theoretical capacity of a single first digit of subscriber numbers under the current arrangements).
- Even at a high demand level of one number per head of population, only about half the Departments would need more than 1 million numbering capacity[16].

There might be enough spare numbers, but there might also be too few spare number blocks to make allocation convenient. For Distrito Capital, for example, there are just six unallocated blocks having 100 000 numbers each (according to the figures used in this report).

Figure 3 summarises number block allocation and utilisation at the level of current NDCs[17]. Each of these NDCs has a theoretical capacity of 8 million geographic numbers, as the numbers starting with 0 or 1 must be excluded to avoid clashes with long distance dialling

[15] A block of 30 000 numbers assigned to Compartel has been included in the allocation to this Department, but no utilisation records are available for Compartel. This may account for the relatively low utilisation shown.

[16] If a network uses step-by-step number analysis and routing techniques that attach geographic significance to sequences of digits in SNs, it might limit how numbering blocks can be assigned and thereby reduce the utilisation attained. This is unlikely to be happening in metropolitan areas, where the numbering blocks are large and the utilisation is high (particularly in Distrito Capital, where there is an average of 141 373 numbers per block).

[17] Utilisation data were provided by CRT and use the most recent reports by operators (June 2006).

sequences and with short codes. However, the demands for numbers are more intense in some localities than Figure 3 indicates, because currently:

- Subscriber numbers starting with 9 are available only for public phones. However, public phones do not require 1 million numbers for each NDC.
- Subscriber numbers starting with other particular digits are available mainly for particular Departments. For example, in NDC 1 subscriber numbers starting with 8 are available only for Cundinamarca; they are not allocated to Distrito Capital (though they could be).

The effect of the current restrictions on availability is that in Distrito Capital, for example, of the available subscriber numbers 86% (not 71%) are allocated and 52% (not 44%) are used.

NDC	Population	First SN digits spare	Number of Depart-ments	Numbers used	Numbers allocated[18]	Numbers allocated as a proportion of theoretical capacity	Numbers used as a proportion of numbers allocated	Numbers used as a proportion of theoretical capacity
1	7 117 984	0,1	2	3 506 003	5 663 409	71%	62%	44%
2	7 662 871	0,1	3	1 116 736	2 885 259	36%	39%	14%
4	7 556 556	0,1	3	1 560 444	4 277 346	53%	36%	20%
5	8 442 518	0,1	6	842 498	1 372 496	17%	61%	11%
6	2 807 924	0,1,2,4,5,6	3	546 314	785 134	10%	70%	7%
7	3 861 318	0,1,2,3,4	3	547 467	812 185	10%	67%	7%
8	6 127 876	1,3	13	743 431	1 025 865	13%	70%	9%
Total	43 577 047		33	8 862 893	16 851 694	30%	53%	16%

Figure 3 Population and number utilisation by NDC

2.2.2 Existing regulations

The geographic numbering changes in Decree 25 of 2002 would provide one 3-digit NDC per Department, leaving subscriber numbers unchanged. However, Decree 2455 of 2003 concluded that geographic capacity was sufficient except in Bogotá and postponed implementation of the new geographic codes until required.

Figure 4 shows, in its middle columns, the NDCs in Decree 25 of 2002 (and, in its right-hand columns, the NDCs used in an alternative that is discussed in Section 2.3).

[18] The allocation totals in this column are those for the Departments belonging to the NDC, including a few blocks in other NDCs. This has been done for consistency with the totals for used numbers, which are only available by Department. Figure 2 shows that the differences at NDC level are very small.

		First SN digits (given in decreasing order of size of allocation) with **allocations of …**			**Proposed NDCs in Decree 25 of 2002**			**Alternative NDCs in the spirit of Decree 25 of 2002**		
Department abbreviation	**Main NDC**	**Over 100 000**	**From 10 000 to 100 000**	**Under 10 000**	**New NDC**	**Like main (old) NDC**	**Like SNs**	**New NDC**	**Like main (old) NDC**	**Like SNs**
CUN	1	8		9	615	Y	N	618	Y	Y
D.C.	1	2,6,3,7,4,5		9	610	Y	N	612	Y	N
CCA	2	8	2	9	623	Y	N	628	Y	Y
NAR	2		7	9	626	Y	N	627	Y	Y
VAL	2	6,2,4,5,3,8,9			620	Y	N	626	Y	Y
ANT	4	3,4,2,5,8	9		640	Y	N	643	Y	Y
CHO	4		6	9	646	Y	Y	646	Y	Y
COR	4	7	8	9	643	Y	N	647	Y	Y
ATL	5	3	8	9	650	Y	N	653	Y	Y
BOL	5	6		5,4,9	652	Y	N	656	Y	Y
CES	5		5	9	656	Y	N	655	Y	Y
GJR	5		7	9	658	Y	N	657	Y	Y
MAG	5	4		9,6	654	Y	Y	654	Y	Y
SUC	5		2	9	659	Y	N	652	Y	Y
CDS	6	8		9	664	Y	N	668	Y	Y
QUI	6	7		9	662	Y	N	667	Y	Y
RIS	6	3		9	660	Y	N	663	Y	Y
ARC	7		8	9	669	N	N	678	Y	Y
N.S	7	5			672	Y	N	675	Y	Y
SDR	7	6	7		670	Y	N	676	Y	Y
AMZ	8			5,9	608	N	N	681	Y	N
BOY	8	7		6,9,5	677	N	Y	677	Y	Y
CAQ	8		4	9,5	600	N	N	684	Y	Y
CAS	8		6	9	667	N	N	679	N	N
GNA	8			5	609	N	N	687	Y	N
GVR	8			5	603	N	N	686	Y	N
HUI	8	8		9,5	682	Y	N	669	N	N
MET	8	6		9,5	668	N	N	666	N	Y
PUT	8		4	5,9	607	N	N	664	N	Y
SND	8		5	9	679	N	N	659	N	N
TOL	8	2		9,5	680	Y	N	662	N	Y
VCH	8			5	605	N	Y	688	Y	N
VPS	8			5	602	N	N	685	Y	N

Figure 4 Departmental subscriber numbering and possible new codes

The geographic numbering changes in Decree 25 of 2002 appear to have had as objectives:

- To relieve all geographic capacity shortages, both foreseen and unforeseen.
- To create a uniform 10-digit numbering plan.
- To liberate numbering space currently occupied by geographic numbers, for non-geographic purposes.

The changes proposed 33 new 3-digit NDCs starting with 6, one per Department; with existing 7-digit subscriber numbers, these would provide 8 million numbers for each Department. The new 6XY NDCs proposed (in the middle columns of Figure 4) were evidently chosen because they were not in use[19]. Beyond that, the rationale for the specific code choices is not clear. In many countries, new codes are formed from old codes or subscriber numbers in a simple way (for example, by prefixing old codes by a digit, or sometimes by repeating an existing digit). By contrast, as the middle columns of Figure 4 show, the codes in Decree 25 of 2002 resemble the existing codes only in part and the existing subscriber numbers hardly at all. (Resemblance to an existing code would involve incorporating the code as the second digit of the new code; resemblance to existing subscriber numbers would involve repeating a frequently used first digit of subscriber numbers as the third digit of the new code.)

The geographic numbering changes in Decree 25 of 2002 had two stages:

1. Changing NDCs to those shown in the middle columns of Figure 4.
2. Requiring full national dialling for all calls (thereby withdrawing local dialling).

Some additional capacity in the problem area, Bogotá, would come from stage 1: Distrito Capital would be split from Cundinamarca, so that it could use the same numbers as Cundinamarca with different meanings. This would free the initial digit 8, giving a 14% increase in capacity from 7 million to 8 million. (This calculation ignores the small space that must be reserved under the initial digit 9 for public phones.)

In order to enhance Bogotá capacity further, stage 2 would be needed. This would provide a further 25% increase in capacity, as subscriber numbers starting with 0 and 1 could then be used (in national numbers of the forms 610 0xx xxxx and 610 1xx xxxx), bringing the total to 10 million. If yet more capacity were required, new codes (presumably from the 61Y series) would be overlaid on the Bogotá area, with each extra code providing another 10 million numbers.

The geographic numbering changes in Decree 25 of 2002 would achieve the three objectives suggested above. But they would do this with the following disadvantages:

- If stage 2 were needed, everybody would lose local dialling and would have to dial at least 3 more digits (and perhaps more) on what used to be local calls.
- Outside Cundinamarca and Distrito Capital, the large number of NDC splits would serve little purpose beyond clarifying Departmental boundaries. The extra numbering capacity that the splits would provide is not required. The trends towards fewer, more dispersed exchanges and smaller distance differentials in tariffs are usually matched in numbering changes by fewer, larger NDC areas. Unnecessary area splits seem to be a retrograde step.
- The new codes have no clear logic and look hard for people to learn.

[19] This is a desirable property in numbering changes, because it makes it easy to have parallel running of old and new numbers before the change, and changed number announcements on the old numbers for as long as desired after the change.

When Decree 25 of 2002 was devised, growth prospects for fixed access networks may have seemed higher than they do today. Operator contributions to this study indicated that:

- The operators now foresee only modest additional requirements for geographic numbering at fixed locations.
- The operators consider that the geographic numbering changes in Decree 25 of 2002 do not currently need to be implemented and should be reviewed.
- Some operators would find major geographic numbering changes costly to implement and would prefer postponement for some years, when future networks will permit much cheaper implementations.

2.3 Options in Colombia

Several options for geographic numbering changes, besides those in Decree 25 of 2002, can be considered. Figure 5 characterises some of these options, with examples. (For simplicity it ignores details related to parallel running.) It shows that if the current number capacity becomes inadequate then options 3 and 4 offer satisfactory expansions. Of course they (and indeed option 2) do not conform with the current regulations.

Both options 3 and 4 make extra geographic numbering space available, by prefixing a digit to subscriber numbers in the areas where there are shortages of subscriber numbers. They also make extra non-geographic numbering space available, by prefixing a digit to some national numbers with geographic interpretations. However, the numbering changes to make extra geographic numbering space available and to make extra non-geographic numbering space available are independent of one another for these options: there are variants that just prefix a digit to subscriber numbers associated with NDC 1 (or with NDCs 1, 2 and 4) without making extra non-geographic numbering space available, and variants that just prefix a digit to NDCs for geographic numbers without making extra geographic numbering space available. (Strictly this is so only if 9 is prefixed to subscriber numbers; prefixing any other digit effectively entails splitting numbering areas and therefore introducing extra NDCs,) The variants that just make extra geographic numbering space available deserve serious consideration.

There are many other ways of making extra non-geographic numbering space available. For example, NDCs 1, 2, 4, 5 and 6 could be changed to NDCs 61, 62, 64, 65 and 66 respectively while NDC 7 would be changed to NDC 73 or 60 and NDC 8 would be changed to NDC 74 or NDC 66; in the last case there would also need to be previous changes in NDC 8, of 7xx xxxx to 4xx xxxx (but with 72x xxxx, 73x xxxx and 76x xxxx becoming 40x xxxx, 41x xxxx and 49x xxxx), of 8xx xxxx to 5xx xxxx (but with 86x xxxx becoming 55x xxxx), and of 90x xxxx and 93x xxxx to 91x xxxx. However, the most promising ways of making extra non-geographic numbering space available are included in options 3 and 4 of Figure 5.

ption	NDCs for geographic numbers	NSN lengths for geographic numbers	SN lengths for geographic numbers	Examples of digits dialled in complete numbers	Transition	Local dialling	Theoretical geographic capacity for areas of current NDCs 1, 2 and 4 (millions)	Theoretical geographic capacity (millions)	Theoretic non-geograph capacity (millions)
Proposed digit NDCs Decree 25 2002	6XY with X and Y as in the middle columns of Figure 4	10	7	Local: 964 0235 National: 01 610 964 0235	Bad	Kept	16, 24 and 24	264	8000
	6XY for all X and Y		10	National: 01 610 964 0235	Worse	Lost	100, 100 and 100	1000	
Alternative digit NDCs the spirit of ecree 25 of)02	6XY with X and Y as in the right-hand columns of Figure 4	10	7	Local: 964 0235 National: 01 612 964 0235	Better than that for proposed 3-digit NDCs in Decree 25 of 2002	Kept	16, 24 and 24	264	8000
	6XY for all X and Y		8 and 7				80, 80 and 80	390	
Both 2-git and 3-git NDCs	61 and 6XY with X not 1	10	8 and 7	Local: 9964 0235 National: 01 61 9964 0235	Good	Kept	80, 8 and 8	152	8000
	61, 62, 64 and 6XY with X not 1, 2 or 4						80, 80 and 80	296	
Both 1-git and 2-git NDCs	1 and 6X	9	8 and 7	Local: 9964 0235 National: 01 1 9964 0235	Moderate	Kept	80, 8 and 8	160	7200
	1, 2, 4 and 6X						80, 80 and 80	320	5600
nchanged digit NDCs	1, 2, 4, 5, 6, 7 and 8	8	7	Local: 964 0235 National: 01 1 964 0235	Perfect	Kept	8, 8 and 8	56	3400
			8	National: 01 1 964 0235	Good	Lost	10, 10 and 10	62	2800

Figure 5 Comparison of geographic renumbering options

In more detail the options in Figure 5 are as follows:

1. **Proposed 3-digit NDCs in Decree 25 of 2002**. This option comprises the geographic numbering changes in Decree 25 of 2002 discussed in Section 2.2.

   The separate stages (changing to 3-digit NDCs and withdrawing local dialling) are distinguished from each other in Figure 5.

2. **Alternative 3-digit NDCs in the spirit of Decree 25 of 2002**. This option is a minimal variant of option 1 that makes the transition easier for users and keeps local dialling. It simply changes the specific codes proposed for each area to alternatives which are more closely related to existing (or adjacent) NDCs and subscriber numbers, as shown in the right-hand columns of Figure 4[20]. Also, by using 612 as the code for Distrito Capital (instead of 610, which is chosen in option 1), it preserves the possibility of moving Cundinamarca and Distrito Capital to a 2-digit code with 8-digit subscriber numbers. (The 2 could simply be absorbed into the front of subscriber numbers and new ranges, starting with 3, 4 and so on, would be opened.)

   The separate stages (changing to 3-digit NDCs and introducing 2-digit NDCs) are distinguished from each other in Figure 5.

3. **Both 2-digit and 3-digit NDCs**. This option uses 8-digit subscriber numbers for Cundinamarca and Distrito Capital (or just for Distrito Capital) but not necessarily elsewhere. As geographic number shortages are likely mainly in the Bogotá area, using mixed lengths for subscriber numbers is attractive.

   For this option, actions (not necessarily in this order) could be:

   - Put 6 before the NDC 1 (making it 61). (Alternatively, for tariff transparency and ease of transition, put 6 just before numbers in Distrito Capital.)
   - Put 9 before all subscriber numbers for the new NDC 61 (giving them 8 digits). (Putting 9 before the numbers may prevent parallel running with the 92x xxxx and 93x xxxx ranges of the current NDC 1, where 11 100 numbers are allocated already; however, putting 8 before all subscriber numbers for the new NDC 61 except those beginning with 9 permits full parallel running there if at most Distrito Capital has the new NDC 61, provided that local dialling is not available across Department boundaries.)
   - Put 60, 62, 64, 65 or 66 before all other NDCs for geographic areas. (The choice of NDCs to be prefixed by 60, 62, 64, 65 and 66 could depend on the balance between simplicity of transition and density of utilisation.)

   Variants on this option include using a first digit other than 6 for geographic numbering, such as 2, 4 or 5 (which could all be put before the NDC 1, with 20, 40 or 50 put before all other NDCs). Doing this would be in line with the widespread use internationally of low first digits to identify geographic numbering; it would also let the first digit 6 be used for non-geographic NDCs only.

   However, using 6 as the first digit of geographic NDCs would permit another possibility, having 8-digit subscriber numbers in Cali and Medellín as well as in Bogotá. The actions (again with possible variants) could be:

   - Put 6 before the NDCs 1, 2 and 4 (making them 61, 62 and 64). (Alternatively, for tariff transparency and ease of transition, put 6 just before numbers in Distrito Capital, Valle del Cauca and Antioquia.)

[20] These code choices are only illustrative; many variants are possible.

- Put 9 before all subscriber numbers for the new NDCs 61, 62 and 64 (giving them 8 digits). (Putting 9 before the numbers may prevent parallel running with the 92x xxxx and 93x xxxx ranges of the current NDCs 1, 2 and 4, where 11 100 numbers, 2 000 numbers and 19 900 numbers, respectively, are allocated already; however, putting 8 before all subscriber numbers for the new NDC 61 except those beginning with 9 permits full parallel running there if at most Distrito Capital has the new NDC 61, putting 7 before all subscriber numbers for the new NDC 62 except those beginning with 9 permits full parallel running there if at most Valle del Cauca and Cauca have the new NDC 62, and putting 6 before all subscriber numbers for the new NDC 64 except those beginning with 9 permits full parallel running there if at most Antioquia and Córdoba have the new NDC 64, provided that local dialling is not available across Department boundaries.)
- Put 60, 65 or 66 before all other NDCs for geographic areas. (The choice of NDCs to be prefixed by 60, 65 and 66 could depend on the balance between simplicity of transition and density of utilisation.)

There is of course no need for most of these actions just to expand the geographic numbering space in selected areas; for example, NDCs 5, 7 and 8 could be left unchanged, instead of being replaced by 3-digit NDCs with first digit 6. However, these extra actions serve to make available extra distinctive first digits of NDCs for non-geographic numbering and are therefore recommended in Section 2.4 and Section 3.4.

The two possibilities (with 8-digit subscriber numbers for the current NDC 1 and with 8-digit subscriber numbers for the current NDCs 1, 2 and 4) are distinguished from each other in Figure 5.

4. **Both 1-digit and 2-digit NDCs**. This option uses 8-digit subscriber numbers for Cundinamarca and Distrito Capital (or just for Distrito Capital) but not necessarily elsewhere.

   For this option, actions (not necessarily in this order) could be:

   - Put 9 before all subscriber numbers that are intended to remain in NDC 1 (giving them 8 digits). (The same potential problems and similar resolutions arise as for option 3, so 8 might be used as the first digit instead.)
   - Put 6 before the NDC 1 for any subscriber numbers that are not intended to remain in NDC 1 (making it 61).
   - Put 6 before the NDCs 2, 4, 5 and 6 (making them 62, 64, 65 and 66).
   - Replace the geographic NDC 8 by 60.
   - Replace the geographic NDC 7 by 61. (However, if part of NDC 1 moves to NDC 61 to permit full parallel running in the rest of NDC 1, the range 8xx xxxx of NDC 7, currently containing 23 800 allocated numbers, must already have been replaced by 2xx xxxx.)

   In this case, too, 8-digit subscriber numbers could be introduced in Cali and Medellín as well as in Bogotá. The actions (again with possible variants) could be:

   - Put 9 before all subscriber numbers intended to remain in NDCs 1, 2 and 4 (giving them 8 digits). (The same potential problems and similar resolutions arise as for option 3, so 8, 7 or 6 might be used as the first digit instead.)
   - Put 6 before the NDCs 1, 2 and 4 for any subscriber numbers that are not intended to remain in NDCs 1, 2 and 4 (making them 61, 62 and 64).
   - Put 6 before the NDCs 5 and 6 (making them 65 and 66).
   - Replace the geographic NDC 8 by 60.

- Replace the geographic NDC 7 by 61. (However, if part of NDC 1 moves to NDC 61 to permit full parallel running in the rest of NDC 1, the range 8xx xxxx of NDC 7, currently containing 23 800 allocated numbers, must already have been replaced by 2xx xxxx.)

Again there is no need for most of these actions in these two possibilities just to expand the geographic numbering space in selected areas; in particular, NDC 7 or NDC 8 could be left unchanged to simplify moving part of NDC 1 to NDC 61.

The two possibilities (with 8-digit subscriber numbers for the current NDC 1 and with 8-digit subscriber numbers for the current NDCs 1, 2 and 4) are distinguished from each other in Figure 5.

5. **Unchanged 1-digit NDCs**. This option involves doing nothing or as little as possible, at least for some years. (Of course, all other options remain open and can still be chosen if needed later.) While uniformity is desirable in a numbering plan, the current two-length arrangement is not far from uniform and offers relatively short geographic numbers and minimal changes[21]. Figure 3 shows that even in NDC 1 only 44% of the 8 million numbers are currently used. CRT and the operators could affect the available capacity, because:

   - Utilising the first digits 2, 3, 4, 5, 6, 7 and 8 in subscriber numbers fully might allow, say, 70% of the 7 million numbers to be used.
   - Routing after full digit analysis would let the capacity be used much more efficiently[22].
   - Mobile substitution might balance any underlying growth in demand for fixed lines.
   - Providers of services such as VOIP and corporate access could be encouraged to use non-geographic numbering.
   - Allocations of geographic numbers in some NDCs could have small annual charges.

   A 25% increase in capacity could be obtained by withdrawing local dialling in some NDCs Geographic numbers would remain shorter than non-geographic ones, but, to avoid confusion, either the national prefix would be retained for calls to Cundinamarca and Distrito Capital or short codes and carrier selection codes would be lengthened with an escape. Also, the potential non-geographic numbering capacity would be reduced.

   The two possibilities (doing nothing and withdrawing local dialling) are distinguished from each other in Figure 5.

[21] During the 1990s there was an extensive programme of geographic number changes, mainly lengthening subscriber numbers to 7 digits and shortening NDCs, to reach the current position.

[22] This is done in some implementations of number portability. With the current networks, it might not be feasible everywhere in Colombia, but it would not be needed everywhere. It would be needed only where the unused numbering space was relatively low, which would generally be in metropolitan areas that had modern networks and that might introduce next generation networks.

2.4 Recommendations for Colombia

We are not convinced that the geographic numbering plan needs immediate revision. However, the demand for geographic numbering might rise in the future well beyond the levels currently envisaged, through the use of converged services and the allocation of large number blocks to businesses. If that should happen when the first digits 2, 3, 4, 5, 6, 7, and 8 are all well utilised, the most straightforward way of increasing capacity would be to prefix 9 to all subscriber numbers for the affected NDCs. Extra non-geographic capacity could be provided at the same time, or at a different time, by prefixing 6 to some or all geographic NDCs. We recommend:

1. Safeguarding the possibility of making available more geographic numbering space by:
   - Reserving all unopened blocks in the 9xx xxxx range of NDC 1 (except those of the form 90x xxxx or 91x xxxx).
   - Reserving all unopened blocks in the 9xx xxxx range of NDC 2 (except those of the form 90x xxxx or 91x xxxx).
   - Reserving all unopened blocks in the 9xx xxxx range of NDC 4 (except those of the form 90x xxxx or 91x xxxx).
2. Safeguarding the possibility of making available more non-geographic numbering space by:
   - Reserving all non-geographic numbers with 60Y and 61Y NDCs and reserving the 2xx xxxx, 4xx xxxx, 5xx xxxx and 6xx xxxx ranges of NDC 6.
3. Ensuring that allocations of geographic numbers are well utilised before more are allocated.
4. Withdrawing formally the geographic numbering changes in Decree 25 of 2002.
5. Reviewing capacity demand trends annually.

3 Non-geographic numbers

3.1 Experience in other countries

In many countries large parts of the numbering space are reserved for new services that are largely expected to arise from convergence. Before looking at numbering for converged services, however, we discuss non-geographic and geographic numbering in general, illustrating possible choices by examples from various countries. For non-geographic numbering the United Kingdom (UK) is particularly well documented, though countries in Latin America such as Peru also have interest. The Netherlands offers a good example of a corporate service in which the regulator allocates number blocks not to service providers but to organisations for their own use.

3.1.1 UK

In the UK, there have been corporate numbers, nomadic numbers and personal numbers, as well as premium rate numbers, national rate numbers, local rate numbers and freephone numbers. However, problems with the number ranges have led to proposals to replace some of them with others and to regulate their prices more stringently. For example:

- Corporate numbers with NDC 55 have not proved popular: though 35 blocks, each with 10 000 numbers, have been allocated, only 8 seem to have public uses (for residential VOIP numbers from the incumbent, not for corporate numbers). The regulator, Ofcom, has not decided how to allocate these numbers to corporate bodies other than operators or what should be the tariff arrangements.
- Nomadic numbers with NDC 56 have been more popular: more than 200 blocks, each with 10 000 numbers, have been allocated, with about 50% going to the incumbent for further VOIP services. Ofcom now regards the 5X NDCs formerly allocated to corporate numbers and nomadic numbers as “for future use” (though it also claims to have no plans to stop using them). Ofcom may nonetheless devote 6X NDCs to personal numbers that seem to have purposes like those of the nomadic numbers.
- Personal numbers have been misused (as unsupervised premium rate numbers) and have lacked any clear or consistent tariff structure. Ofcom decided that[23]:
  - Calls to personal numbers will have ceilings on their tariff rates, unless there are free announcements of the charges at the starts of calls.
  - The NDC 70 for personal numbers will be re-allocated within three years, so that all 7X NDCs will be reserved for mobile numbers, by transferring any genuinely personal numbers (using “find me / follow me” services) to new 6X NDCs[24].
- Premium rate numbers require a special regulator, with a code of practice that becomes ever more elaborate, to protect customers against ever more devious tricks of the trade.

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[23] See *Telephone Numbering - Safeguarding the future of numbers* (Ofcom, July 2006) at http://www.ofcom.org.uk/consult/condocs/numberingreview/statement/statement.pdf.

[24] A “find me /follow me” service is one in which calls to a number are diverted to other numbers. In some versions of the service, the numbers to which the calls are diverted can be changed by the customer for the service, can be called in sequence or in parallel and can be different for different callers. Such services have been available for some years without becoming very popular. They might become more widespread in VOIP systems, which can support elaborate and detailed choices for subscribers more readily than traditional systems.

- National rate numbers have become puzzling to callers (because call charges to geographic numbers have reduced much more than call charges to these numbers, so they are no longer charged at national rates). They also have been misused in the same way as personal numbers. They have therefore become the focus for objections by various organisations[25]. To deal with these problems Ofcom decided that[26]:
  - Calls to numbers with NDC 870, where charges are supposed to match national rates, will be charged as if they were long distance calls made using the tariff package of the caller, unless there are free announcements of the charges at the starts of calls[27].
  - Calls to with NDC 871, where charges have diverged significantly from national rates, will be regulated as premium rate calls, even though the calls are cheaper than conventional premium rate calls and do not use a 9XY NDC.
  - New 3X NDCs will provide calls charged at or below national rates nonetheless. Public bodies had been discouraged from using local rate and national rate numbers. (This may be relevant to the use of charging modality 3 for short codes in Colombia.) Nonetheless 3x NDCs are to be used only by public and not-for-profit bodies initially.
- Local rate numbers have been successful with companies using them to provide services but have become puzzling to callers for the same reason as national rate numbers. Ofcom decided to not to link the charges call charges in the same way as for national rate numbers, because local rate numbers are still used by dial-up internet service providers, who rely on them for revenue. However, Ofcom will review the position after two years, when dial-up internet service provision will have declined greatly.

A lesson from this is that opening new non-geographic numbering ranges without very clear criteria for the allocation, tariffing and use of the numbers is likely to bring into disrepute all non-geographic numbering (except that which is very distinctive and familiar, such as for freephone). Having large numbers of spare NDCs may tempt a regulator into profligate creation of classes of number that are not well understood and may be misused. (We are not suggesting that Ofcom has learned this lesson.)

3.1.2 Peru

In Peru NDCs 802, 804 and 806 are reserved for universal numbers, personal numbers and corporate numbers respectively. A similar distinction between universal numbers and personal numbers is also made in Ecuador (and indeed in Ireland). Doing this recognises that Universal Personal Telephony (UPT) can split into distinct services thus:

- Universal telephony is a service that connects the caller to the “owner” of the number at one of (possibly) several locations to which calls to the number are directed.
- Personal telephony is a service that allows the “owner” of the number to change the location to which calls to the number are directed.

The first of these is very similar to a corporate service, which itself resembles a freephone service except by not being free always. The second of them is very similar to a ‘nomadic’ service or even a mobile service if it makes no assumptions about whether the “owner” changes the location by manual registration or through automatic handover between cells.

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[25] For a website devoted to opposing the use of these numbers see http://www.saynoto0870.com.

[26] See *NTS: A Way Forward* (Ofcom, April 2006) at http://www.ofcom.org.uk/consult/condocs/nts_forward/statement/statement.pdf.

[27] The tariff package of the caller is the set of prices determined by the contract of the caller. This might say, for example, that long distance calls were free at certain times of day or that calls to mobile phones were priced like long distance calls.

3.1.3 Netherlands

In various countries that have corporate numbering relatively few corporate numbers seem to have been allocated. Potential customers are confused about how the service differs from freephone and other services, about how the numbers are allocated, tariffed and used, and about the relation between corporate numbering and internal Virtual Private Network (VPN) numbering.

An exception may be the Netherlands, where there has been a well publicised process for allocating these numbers (with NDC 88) during the past two years. In that time more than 950 000 numbers, in 1 300 blocks, have been allocated, mainly to organisations that are not service providers. Almost 84% of the blocks have 100 numbers, 12% have 1 000 numbers, 4% have 10 000 numbers and the remaining two have 100 000 numbers[28].

3.2 The current position in Colombia

3.2.1 Existing allocations

Figure 6 shows the current use or reservation of each possible first and second digit of NSNs in the national numbering plan. (In this plan this 'first digit' is the first digit dialled after the long distance national or international prefix such as 05 or 005; it is therefore the first digit of the NDC and, for a geographic number, the only digit of the NDC.) Figure 6 also shows the use proposed in Decree 25 of 2002 for each possible first digit. In all cases each subscriber number has 7 digits.

[28] These figure are derived by examining the registrations recorded by the regulator, OPTA. See http://www.opta.nl/asp/en/numberingissues/telephoneandrelatednumbers.

First digit	Second digit	Use or reservation now	NSN length now	Use in Decree 25 of 2002	NSN length in Decree 25 of 2002
0	All	Unused	-	Unused	-
1	2,3,4,5,6,7,8,9	Bogotá and Cundinamarca	8	Reserved	10
	0,1	Unused	-		
2	2,3,4,5,6,7,8,9	Cali and South-West region	8	Reserved	10
	0,1	Unused	-		
3	0,1,2	Mobile	10	Mobile and other similar access	10
	5	Trunking	10		
	7	Satellite	10		
	3,4,6,8,9	Unused	-		
4	2,3,4,5,6,7,8,9	Medellín and North-East region	8	Reserved	10
	0,1	Unused	-		
5	2,3,4,5,6,7,8,9	Cartagena and North region	8	Reserved	10
	0,1	Unused	-		
6	3,7,8,9	Manizales and Central region	8	Geographic	10
	0,1,2,4,5,6	Unused	-		
7	5,6,7,8,9	Bucaramanga and North-West region	8	UPT	10
	0,1,2,3,4	Unused	-		
8	2,4,5,6,7,8,9	Islands and South-East region	8	Non-geographic	10
	0	Freephone	10		
	1,3	Unused	-		
9	0	Premium rate and shared cost	10	Non-geographic	10
	1	Shared cost	10		
	4	Internet and other similar access	10		
	2,3,5,6,7,8,9	Unused	-		

Figure 6 Uses of numbering space now and according to Decree 25 of 2002

Figure 6 shows that:

- There are many ways of getting distinctive non-geographic numbering without compressing geographic numbering space. For example, there are over 150 spare 3-digit NDCs that have 3 or 9 as their first digit and there are over 150 spare 3-digit NDCs in the current geographic numbering space that have 0 or 1 as their second digit.
- If extra non-geographic numbering space were wanted, NDC 6, NDC 7 or NDC 8 could be made available easily. For example, NDC 8 could be made fully available by:
  - Moving its 2xx xxxx, 4xx xxxx, 5xx xxx and 6xx xxxx subscriber numbers to the identical numbers of NDC 6.
  - Moving its 7xx xxxx subscriber numbers to the identical numbers of NDC 6, except for 133 100 numbers in the ranges 73x xxxx, 74x xxxx, 75x xxxx and 76x xxxx, which would be changed to the corresponding 40x xxxx, 44x xxxx, 45x xxxx and 41x xxxx numbers of NDC 6.

- Changing its 8xx xxxx subscriber numbers to the corresponding 5xx xxxx numbers for NDC 6, except for 16 200 numbers in the range 86x xxxx, which would be changed to the corresponding 55x xxxx numbers of NDC 6.
- Moving its 9xx xxxx subscriber numbers to the identical numbers of NDC 6, except for 2 000 numbers in the range 90x xxxx (in Boyacá and Huila), which would be changed to the corresponding 91x xxxx numbers of NDC 6.

The NDC 6 area would remain geographically coherent: the departments in the NDC 8 area would move into the NDC 6 area. (Slightly simpler migrations would differ from this by associating either just Boyacá or both Boyacá and Huila with NDC 7; geographic coherence would be reduced if Huila were associated with NDC 7, but this might not matter, as calls from adjoining departments into Huila are probably rather rare.) In addition the departments in the NDC 7 area could move into the NDC 5 area by changing the first digit of all the numbers except for those in the range 9xx xxxx and by changing also the second digit of 231 300 numbers. (We are not advocating that these changes be made; we are merely showing that fairly simple changes are possible.)

- The first digit 9 provides up to 1 billion numbers (with 10-digit lengths), which would probably be ample for foreseeable non-geographic services if there were no need to make numbers distinctive or short. (It represents ten times the capacity set aside for these services in the NANP.)
- The first digit 7 is intended for UPT according to Decree 25 of 2002 (which also stipulates that UPT numbers should be portable between operators). As UPT is a personal telephony service, providing up to 1 billion numbers for the 40 million people of Colombia seems lavish. Of course, no UPT numbers have been allocated so far in Colombia. Indeed, few UPT numbers have been allocated in various countries that have set aside numbers for UPT, because mobile numbers fulfil similar functions.
- Currently fewer than 15 000 non-geographic numbers having first digit 8 or 9 have been allocated (to various services, in accordance with Figure 6)[29]. However, if some non-geographic numbers had fewer than 10 digits there might be a need for more non-geographic numbering space. In particular, if they had 6 digits (so they might be substitutes for short codes) then 100 3-digit NDCs would be needed for providing 100 000 numbers (which is not a huge supply for a country as large as Colombia), even ignoring the wish for distinctive numbers.

A major question here is “how much capacity is enough for the long term?” There are no easy answers. To address it (whether for geographic or non-geographic services), one should look at not just quantity but also ‘quality’ (the availability of distinctive NDCs and, for information services, memorable numbers). As the distinction in tariffing terms between 90Y and 91Y NDCs is already unclear, the quality of non-geographic NDCs seems to pose at least as important a problem as the quantity of non-geographic NDCs.

In fact potential shortages of geographic numbering space appear more severe than potential shortages of non-geographic numbering space. However, in Section 2.3 we provide options for dealing with potential shortages of geographic numbering space that also make available much more non-geographic numbering space and even several distinctive first digits for non-geographic NDCs (as exhibited in Figure 5). These options are implicit in the recommendations in Section 3.4.

[29] Utilisation data were provided by CRT and use the most recent reports by operators (June 2006).

3.2.2 Dialling in relation to tariffing

An important function of numbering and dialling is to indicate to callers what they will pay for calls. In particular, dialling national numbers suggests to callers that the call charges may be high, whilst dialling just subscriber numbers suggests to callers that the call charges may be low. The exact charges are determined by the tariff packages of the callers, which depend on whether the callers are using fixed phones or mobile phones.

The difference between charges for local and long distance calls is still fairly high in Colombia, though it is likely to fall after market opening in 2007. For this reason, the dialling prefix 01 is used for dialling calls inside the same NDC area but outside the local calling area or extended local calling area of the subscriber. It is also used for calls to other geographic numbers and to specially tariffed numbers. The dialling prefix 03 for calls to or from mobile numbers indicates to callers that these are expensive calls, though 01 could do this equally well. The dialling prefixes 05, 07 and 09 provide access to the long distance networks.

When the dialling prefix is used it is followed by the national number, not the subscriber number. CRT can authorise the use of subscriber numbers instead of national numbers when tariffs justify doing so (as in the case of extended local calling areas). CRT could therefore encourage reductions in tariffs inside NDCs by permitting local dialling in larger areas only if operators offered local charging in those areas.

For calls to non-geographic numbers the NDCs are at least as important as the dialling prefixes in indicating the charges.

3.3 Options in Colombia

The functions of numbers, and in particular of NDCs, are to route calls, to provide information to callers and (in the case of emergency calls, for example) to provide information to people receiving calls. Among the kinds of information that could be provided in NDCs are:

- Pricing.
- Location.
- Length of number.
- Access network operator.
- Nature of content.
- Degree of mobility.
- Variety of media (voice, video, text and so on)[30].

However, for most of these the distinctions available in the information are very elusive and, in any case, probably would not be memorable or very useful to people. For example, the degree of mobility is not sharply defined: even the distinction between manual registration and automatic handover is blurred when calls can be re-established with imperceptible delays. (Also, of course, identifying the access network operator in the NDC runs counter to providing number portability.)

Using NDCs to make elaborate distinctions between classes of call would not help users much and could lead to disputes about whether operators are entitled to use certain NDCs. We do not generally favour making elaborate distinctions that include different kinds of information in NDCs.

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[30] The ITU recommends not using NDCs to provide information about quality of service. See *Alternatives for carrier selection and network identification*, ITU-T recommendation E.164 supplement 1 (ITU-T, March 1998) at http://www.itu.int/rec/T-REC-E.164-199803-I!Sup1.

Simple distinctions in NDCs, to tie numbering to price ceilings, can improve tariff transparency. However, even these distinctions between NDCs become unnecessary when there are other means of providing advice of charge information (such as messages announced or displayed before calls).

Tying numbering to price ceilings need not require the regulator to determine prices for services: the regulator would require the use of certain non-geographic NDCs for certain prices but the operators might choose the prices for their services. (There might also be exemptions for calls starting with free announcements about the charges.) The tie between numbering and price ceilings can take one of the following forms:

- **Absent**. The price ceilings would not exist. However, before every voice call or text message a free warning would be announced or displayed. (Checking the form and content of such messages can be labour-intensive.)
- **Absolute**. The price ceilings would be determined by the regulator and adjusted by the regulator, either by applying rules automatically each year or by conducting reviews. (This approach is already adopted in Colombia for short codes having charging modality 4.)
- **Relative to other expectations of customers**. The price ceilings would be clearly related to the tariff packages of the callers for local and national calls from fixed phones and for on-net and off-net calls from mobile phones. (Something like this approach is already adopted in Colombia for short codes having charging modality 3.) These tariff packages might be allowed to include special prices for non-geographic NDCs if they were prominently displayed in customer contracts and bills. There would be no regulation of the price ceilings other than any already applied to the operators for their fixed and mobile services; in particular, the regulator would not need to regulate long distance call charges that were not already regulated.

The called party would also make rental or call-by-call payments; some of these might be transferred by interconnection payments to different operators in the chain. This is already what happens with out-of-area geographic numbers in various countries; the most extreme case is the US, where local calls are typically free to the callers, so the called parties pay the full costs[31]. However, it can complicate interconnection negotiations (especially when the price ceilings are relative) and require interconnection charges that differ from the norm in Colombia by not being based just on capacity[32].

We suggest tying non-geographic numbering mainly to price ceilings. Some of the price ceilings would be absolute (for freephone and premium rate services) and some would be related to the tariff packages of the callers. There would be at least one price ceiling that would limit charges to the local rates in the tariff packages of callers from fixed phones; there might be other price ceilings lying between the local rate and the national rate (as there is a large difference between local call charges and long distance call charges in Colombia), among them being, in particular, a price ceiling that would limit charges to the extended local rates in the tariff packages of callers from fixed phones. (Three price ceilings, for local rate, extended local rate and national rate, would be needed for accommodating variations in dial-up internet access.) We see no reason to introduce new NDCs for non-geographic numbers tariffed at the mobile rates in the tariff packages of callers from fixed phones: the existing NDCs for mobile numbers could be used instead.

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[31] Out-of-area geographic numbers are geographic numbers that let people receive calls even when they are not in the locations represented by the numbers, so that clients, friends or relatives can call them at local rates.

[32] For a description of the interconnection charging system in Colombia see *Implementing Capacity-Based Interconnection Charges* (ITU, December 2003) at http://www.itu.int/ITU-D/treg/Case_Studies/Convergence/Colombia.pdf.

If there were several price ceilings, operators allocated numbers for higher price ceilings might also be allocated automatically corresponding numbers for lower price ceilings, to encourage them to move to those ceilings; for example, the NDCs 920 and 930 might represent different ceilings such that an operator allocated numbers for NDC 930 (which would have the higher ceiling) would also be allocated numbers for NDC 920 (which would have the lower ceiling). (Also, for premium rate services there might be multiple price ceilings, to have different limits on permitted call durations.) Nonetheless we do not recommend having many price ceilings.

At this stage we are reluctant to suggest specific NDCs for specific price ceilings. We incline to think that if two NDCs represent different price ceilings then their NDCs should differ in their first digits, or, failing that, in their second digits. This principle is not currently adopted for NDCs 900 and 901, but could be introduced by changing the NDC of about 500 numbers.

Automatic transformations of short codes into non-geographic numbers, such as those mentioned in Section 5.3 and Section 8.3, suggest using the first digits of NDCs to differentiate between price ceilings, except for person-to-person calls. However, the distinction between person-to-person calls and other calls is not sharp: a call to a help desk, for example, might be either. Hence these automatic transformations suggest using the first digits of NDCs to differentiate between price ceilings for all calls to non-geographic numbers.

We suggest that the 80Y NDCs (and perhaps the 81Y NDCs) should be reserved entirely for freephone services, which may want memorable numbers and short numbers. Unless the 9XY NDCs have already gained a reputation for having high prices or there are to be more than about four price ceilings (which we would not recommend), other non-geographic person-to-person services could be given 9XY NDCs. However, an alternative, in keeping with the automatic transformations suggested above, would involve using other first digits for other services; thus the 50Y NDCs (and perhaps the 51Y NDCs) might be used for local rate services and the 70Y NDCs (and perhaps the 71Y NDCs) might be used for national rate services. (Doing this would entail clearing the short code 137 if the automatic transformations of short codes into non-geographic numbers were adopted.)

The lengths of non-geographic numbers could be allowed to be less than 10 digits: NDCs would identify the number lengths as well as the price ceilings. We do not favour implementing this now, but we favour allowing for it to be implemented later, as it can help with reducing the problems associated with short codes.

For specific services we expect that:

- Corporate numbers might serve to reduce the pressure on geographic numbering and assist the development of the market in business telecommunications. CRT would allocate number blocks direct to businesses that could then choose and move between operators. (The rules for the utilisation of allocated numbering blocks are discussed in Section 12.1.3.) However, we are not clear that the demand for corporate numbers in Colombia would justify introducing them, with the inevitable need to educate users and lay down extra allocation procedures.
- Nomadic numbers might be allocated for VOIP services. However, we suggest in Section 4.3 that they would not be the only numbers allowed for VOIP services, and they might not ultimately prove to be very popular.
- Personal numbers would be regarded as nomadic numbers. Some VOIP services can provide customers with optional “find me / follow me” services; customers should not be obliged to change their numbers just because their service providers have introduced or they have taken such options, so nomadic numbers take the role of personal numbers. (In fact the first service to use the ITU country code for UPT is actually a VOIP service.)

If non-geographic numbering were tied mainly to price ceilings, there could be nomadic numbers and internet access numbers, for example, with the same NDC: the NDC would represent the price ceiling for calls, not the service being offered.

3.4 Recommendations for Colombia

We feel that the non-geographic numbering scheme deserves some further development, particularly to accommodate converged services and maintain clear numbering and tariff arrangements. We recommend:

1. Safeguarding the possibility of making available more non-geographic numbering space by:
   - Reserving all non-geographic numbers with 60Y and 61Y NDCs and reserving the 2xx xxxx, 4xx xxxx, 5xx xxxx and 6xx xxxx ranges of NDC 6.
2. Safeguarding the possibility of allocating non-geographic numbers in classes according to tariff by safeguarding the possibility of making available more geographic numbering space where and when it is needed by:
   - Reserving all non-geographic numbers with 10Y, 11Y, 20Y, 21Y, 40Y, 41Y, 50Y, 51Y, 70Y and 71Y NDCs.
   - Reserving all non-geographic numbers with 8XY NDCs other than 800.
   - Reserving all non-geographic numbers with 9XY NDCs other than 900, 901, 947 and 948.
3. Consulting the industry and consumer groups about non-geographic numbering classes, dealing with, in particular:
   - Which kinds of information should be embedded in NDCs.
   - How many price ceilings for non-geographic numbers would be needed, and how many numbers would be needed for each price ceiling.
   - How many lengths of non-geographic numbers would be needed, and how many numbers would be needed for each length.
   - Which distinctive NDCs should be adopted.
   - Which current numbers should be moved to fit the distinctive NDCs.
4. Exploring the potential demand among businesses for non-geographic number blocks with number portability.
5. Reviewing the consumer protection arrangements for premium rate services, particularly as these services may become converged services.
6. Reviewing capacity demand trends annually.

4 Converged services

4.1 General aspects

The forms of convergence can be classified as:

- Telephony-internet convergence.
- Fixed-mobile convergence.
- Telecommunications-broadcasting convergence.

These forms of convergence have much in common, because they all use IP. For example, they can all support 'nomadic' use and can all integrate video and text communication with voice communication. However, they might pose different questions for numbering, such as:

- Whether telephony-internet convergence needs geographic numbering.
- Whether fixed-mobile convergence needs mobile numbering.
- Whether telephony-internet convergence needs specially tariffed service numbering[33].

Here we look at them in turn as representatives of new services that could affect numbering.

4.1.1 Telephony-internet convergence

The term 'telephony-internet convergence' (as interpreted in this report) deals with the use of any IP network, not just with the use of the public internet. An example of this is VOIP, where operators may prefer to ensure the quality and security of their services by providing them over private IP networks, having strictly limited and controlled connections with the public internet, instead of just over the public internet. Operators may only provide IP in their core networks (instead of in their access networks), in which case the service has numbering just like other services that do not use IP. Here we confine attention to VOIP services that use IP in access networks and thereby lead to services that are rather different from traditional services.

Some differences between VOIP and traditional services are advantages of VOIP; others are disadvantages. Its advantages particularly relevant to numbering are:

- Supporting 'nomadic' use (so users can make and receive calls by attaching their terminals to networks at various points, not just at fixed locations).
- Permitting user identifications besides numbering, such as Session Initiation Protocol (SIP) Uniform Resource Identifiers (URIs)[34].
- Integrating video and text communication with voice communication.
- Allowing cheaper calls through economies of scale and scope between voice communication and data communication.

Its disadvantages particularly relevant to numbering are:

- Offering variable quality (at least over the public internet).

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[33] In this report 'specially tariffed service numbering' refers to non-geographic numbering excluding mobile numbering. The calls might be free (as with freephone services), expensive (as with premium rate services) or somewhere between (as with shared cost services).

[34] These SIP URIs are very similar to email addresses: the SIP URI sip:person@one-isp.net.co corresponds with the email address written fully as mailto:person@one-isp.net.co.

- Failing to support calls to emergency services fully (by not having reliable power supply through line powering and not providing accurate caller location information).

These disadvantages can easily be overstated. The quality of the public internet, for example, can be quite good: in India, for example, the regulator originally distinguished between the quality expected from two different forms of VOIP but subsequently eliminated the distinction because it was not observed in practice.

If VOIP uses geographic numbers, it can lead to shortages of numbers, because:

- VOIP service providers can serve customers in many geographic areas without needing local exchanges. They may ask for number blocks wherever they have customers, no matter how few customers they may have. (They will not generally be satisfied with being granted instead number blocks just in the geographic areas of their gateways to traditional networks, as these numbers will then lose their geographic significance.) By contrast, traditional fixed access network operators ask for number blocks only in the geographic areas where they have local exchanges.
- If tariffs depend heavily on the NDCs of the calling and called parties, some IP telephony users will want multiple numbers, in different geographic areas and even in different countries (as offered by VOIP service providers such as Skype and Vonage). Low charges for long distance calls or for calls to non-geographic numbers with well-known NDCs can reduce this effect, which is described further in Section 11.1.3

4.1.2 Fixed-mobile convergence

The term ‘fixed-mobile convergence’ has meanings ranging from the use of a single bill for both fixed and mobile services to the provision of a single service over a single network to both fixed and mobile devices. The interpretation of fixed-mobile convergence most relevant to numbering is Fixed Mobile Access (FMA). This supports making and receiving calls through both a fixed network and a mobile network.

Both fixed network operators and mobile network operators may be driven by competition to introduce FMA. Fixed network operators may respond to fixed-mobile substitution (which itself is stimulated by the greater convenience and capability of mobile terminals) in the belief that high proportions of calls through mobile networks are made from fixed home and office locations[35]. Mobile network operators then need to react with at least ‘home zone’ tariffs (reduced tariffs in selected locations). Correspondingly, the numbering associated with FMA might most naturally be geographic numbering or mobile numbering.

Generally FMA has not been very successful so far. It can be expected to be most successful when there is a wide discrepancy between fixed network tariffs and mobile network tariffs (as in Colombia currently), so callers may make calls to FMA users, or may make calls as FMA users from mobile terminals in fixed locations, in the expectation that tariffs will resemble those for fixed access networks.

Early forms of FMA provided Digital Enhanced Cordless Telecommunications (DECT) wireless connections to a fixed network and Global System for Mobile communications (GSM) wireless connections to a mobile network. However the terminals and services that are now appearing use IP with various wireless mechanisms using Unlicensed Mobile Access (UMA) and protocols such as Bluetooth and WiFi, instead of DECT. Operators in France, Italy and the UK have now announced or launched services using such ‘dual mode’

[35] For example, in the UK market research for the incumbent suggested that 30% of mobile calls are made by people at home and that 70% of people choose to avoid mobile tariffs by making fixed calls. See *BT Fusion: the best of both worlds* (BT, May 2006) at http://www.key4biz.it/Presentazioni/TLC/BT_Fusion%5B1%5D.ppt.

terminals. (The use of IP and 'dual mode' terminals will still face competition from GSM in countries such as the UK that have made spectrum available for low-powered GSM suitable for indoor applications.)

4.1.3 Telecommunications-broadcasting convergence

The term 'telecommunications-broadcasting convergence' has meanings ranging from transmitting scheduled information to the general public over a telecommunications network to transmitting specific information to and receiving specific information from a specific user. IP TeleVision (IPTV) could be any of these but is likely to offer greater appeal than traditional broadcast television if it allows users to control the content and timing of transmissions to them. It therefore resembles information services available through the telephone network in some respects. However, because it permits visual interaction it can give users other ways of requesting and paying for content than dialling telephone numbers.

IPTV in general would provide access to content with publicly advertised identifications and might charge for that content, whilst an IP call between friends, even if it involved video, would not have charges for the content (though it might have charges for the extra bandwidth or the higher quality of service).

4.2 Experience in other countries

In many countries there have been discussions about numbering for VOIP services. Several of these have reached the conclusion that VOIP services should be allowed to have both geographic and non-geographic numbers.

4.2.1 UK

The numbering arrangements for VOIP services in the UK were settled in 2004, with the statement that[36]:

- Geographic numbers should be available for VOIP services. This would be so even if the VOIP services did not satisfy the same regulatory conditions (for publicly available telephony services) as traditional fixed access services[37].
- Non-geographic numbers should come from a new range, which would have no price ceiling (though Ofcom would encourage the service providers to include them in standard tariff packages much as if they were geographic numbers). They would not be permitted to have revenue sharing arrangements such as characterise premium rate services.
- Number portability would be required of VOIP service providers. However, it might not be enforced rigorously at first (except in relation to providers of publicly available telephony services), because many VOIP service providers were expected to be small initially. (Also, with the UK implementation of number portability there would be a degradation in call quality, as voice paths would be delayed and recoded by entering and leaving donor networks that used VOIP.)
- Carrier preselection would not be required of VOIP service providers.

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[36] See *Numbering arrangements for new voice services* (Ofcom, September 2004) at http://www.ofcom.org.uk/consult/condocs/vob/nvs_statement.pdf.

[37] In the EU, providers of publicly available telephony services have obligations about number portability, emergency calls, universal service, resilience (especially for publicly available telephony services 'at fixed locations'), directory enquiries, pricing information and itemised bills. They have rights about number portability and directory entries.

The decisions by Ofcom were made knowing that some service areas were likely to have too few geographic numbers, as VOIP service providers are often more interested in having geographic numbers than in having non-geographic numbers. The decisions were therefore followed by measures to conserve geographic numbers. In one of these (an exercise to assess the demand for geographic numbering for VOIP in the UK) the following points emerged[38]:

- Initially VOIP service providers often serve greenfield sites, so they need new numbers.
- Ultimately most VOIP service provision is expected to arise from churn from existing numbers (but this does not reduce number demand if number portability is rare, difficult or missing).
- There is disproportionate demand for numbers in capital and other major cities, where customers outside the country are likely to want (out-of-area) numbers.
- There is high demand for geographic numbers that reflect customer real or assumed locations, so demand in specific area codes cannot be moved to other area codes.
- There is some preference for numbers in towns with technological and academic reputations
- Customers want recognisable geographic numbers, not non-geographic numbers (if the tariffs for non-geographic numbers are not well known).
- Customers want to port numbers only when they regard VOIP as mature.

At the same time, the use of geographic numbering for nomadic services such as VOIP reduces the confidence that callers have in information about locations provided by numbers. Ultimately, particularly when routing spaces are flattened in Next Generation Networks (NGNs), geographic numbers may lose their geographic significance and become just numbers that (when dialled locally) are shorter than most others, with tariffs that are lower than most others.

4.2.2 Ireland

The regulator, ComReg, held a consultation about VOIP services in 2004. The intention was to start a debate about VOIP services by considering numbering (and, in particular, whether new numbering ranges were needed). However, the consultation also looked at matters such as emergency calls, legal interception and extraterritoriality.

The consultation examined which of the existing classes of number could be used for VOIP services; geographic numbers, mobile numbers, personal numbers and premium rate numbers. ComReg took a slightly more cautious view than Ofcom, by stating that[39]:

- Geographic numbers should be available for VOIP services. This would always be so if the VOIP services satisfied the same regulatory conditions (for publicly available telephony services) as traditional fixed access services. It would also be so if the VOIP services did not satisfy these conditions but there was no shortage of numbers in the service areas for which numbers were requested. The numbers would be available only to customers resident in the service area, but nomadic use would be allowed by the regulation, both inside and outside the country.

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[38] See *Study of Geographic Telephone Number Demand* (Intercai Mondiale, May 2006) at www.ofcom.org.uk/consult/condocs/numberingreview/statement/demandmodel.pdf.

[39] See *VoIP services in Ireland – Numbering and related issues* (ComReg, December 2004) at http://www.comreg.ie/_fileupload/publications/ComReg04103.pdf.

- Non-geographic numbers should usually come from a new range, which would have the national rate as its price ceiling (so call charges would not exceed those of long distance calls). ComReg had originally proposed to distinguish various classes of numbers, such as those associated with ENUM and those for video services, but respondents to the consultation generally agreed that doing this would be an unnecessary complication, particularly as new kinds of VOIP services are emerging.
- Non-geographic numbers could generally come from an existing range (such as the personal numbering range used for UPT) where they were being used solely for the purpose for which that range was intended. However, they would not be allowed to come from the premium rate range because the difficulties in protecting customers from premium rate services would be increased by the greater likelihood of extraterritorial operation. Also, they would not be allowed to come from the mobile range, because mobile numbers were in relatively short supply and at that time VOIP services did not provide handover.
- Number portability would be required of VOIP service providers. However, it might not be enforced rigorously at first (except in relation to providers of publicly available telephony services).
- Carrier preselection would not be required of VOIP service providers.
- Calling Line Identification (CLI) should only be transmitted if it would not pass over the public internet. (In principle this could be checked by examining the IP addresses used by the VOIP service provider.)

ComReg held a further consultation to review progress in 2006[40]. This confirmed the view on geographic and non-geographic numbers adopted after the earlier consultation but noted that the non-geographic numbers had not proved popular so far.

4.2.3 EU elsewhere

VOIP services are available throughout the EU with rather little regulation[41]. The most common approach to numbering is like that in the UK and Ireland, with both geographic and non-geographic numbers allowed. In several countries there are more severe restrictions on eligibility for geographic numbers than there are in the UK; the approach taken in Ireland, of requiring that customers having geographic numbers are resident somewhere suitable, is adopted also in Austria and Germany, for example.

4.2.4 Japan

Much the same pattern appears in Japan: there are geographic and non-geographic numbers for VOIP services. Services having geographic numbers should satisfy the same quality of service constraints as traditional fixed access services, with delays less than 150 milliseconds, and provide location information in emergency calls. They can be ported to and from fixed access networks. Services having non-geographic numbers should have delays of less than 400 milliseconds; whether they should be able to access emergency services is

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[40] See *Result of VoIP Framework Review 2006* (ComReg, August 2006) at http://www.comreg.ie/_fileupload/publications/ComReg0645.pdf.

[41] However there has been confusion over the extent to which providers could or could not choose to to label their services as publicly available telephony services. The current view is that if they provide services that appear to be publicly available telephony services then they must accept the obligations, and gain the rights, that are associated with publicly available telephony services. See *The treatment of VoIP under the EU regulatory framework* (European Commission, June 2004) at europa.eu.int/information_society/policy/ecomm/info_centre/documentation/public_consult/index_en.htm.

under discussion. (In principle the delays could be measured using ‘ping’ messages between suitable points.)

4.3 Options in Colombia

In their contributions to this study operators appeared to envisage that new services such as VOIP would use non-geographic numbering, not geographic numbering, but did not say what classes of non-geographic number were suitable.

There is a strong international tendency to let VOIP services have geographic numbers. Here we consider the question of the extent to which geographical numbering should be available to services other than traditional telephony at fixed locations. (Of course, the scope of geographical numbering is already larger than it once was: “traditional telephony” now includes calls to fax machines and remote access servers, and even clear channel 64 kb/s data calls when ISDN is available.) Figure 7 compares the advantages of giving VOIP services geographic numbering, specially tariffed service numbering (with NDCs dedicated to services like VOIP) and mobile numbering. VOIP has many distinctive attributes (supporting ‘nomadic’ use, permitting user identifications besides numbering, and integrating video and text communication), so decisions about its numbering apply immediately to other converged services, such as FMA.

Geographic numbering	**Specially tariffed service numbering**	**Mobile numbering**
Permits local dialling for calls charged like calls to existing geographic numbers		
Reassures callers about relatively low charges		
	Indicates the different nature of the service, with its own good points and bad points	
	Avoids demands for existing numbering space	
Encourages competition with fixed network operators		Encourages competition with mobile network operators
Introduces geographic number portability, if it is required		Introduces mobile number portability, if it is required
	Simplifies route determination in exchanges, if operators have large number blocks	Simplifies route determination in exchanges, if operators have large number blocks

Figure 7 Advantages of different forms of numbering for VOIP

Figure 7 suggests that:

- A VOIP service should be allowed to have geographic numbering if:
  - Users are not misled about the tariff levels for the service. If the tariff levels are regulated by applying standard rules about local calling areas, users are unlikely to be misled.
  - Users are not misled about the bad points of the service. If the bad points are known to the "owner" of the number, who purchased the service, the number itself would only provide useful information to callers and, when the Calling Line Identification (CLI) is displayed, to called parties. This information would be important mainly if emergency calls were directed to, or treated by, agents according to their CLIs.
  - There are no insatiable demands for geographic numbering space. How to satisfy demands for geographic numbering space is considered in Section 2.3.
- VOIP should be allowed to have specially tariffed service numbering. Specially tariffed service numbering might be wanted by VOIP service providers wishing to stress that the service is different. However, the consumer protection arrangements for premium rate services might need to be strengthened if VOIP services became premium rate services, because of the potentially extraterritorial nature of the called location and the possible infeasibility of blocking calls when the entire infrastructure is based on IP. (There are also other consumer protection questions that arise for all VOIP services, even if they are not premium rate services, such as those concerning emergency calls.)
- VOIP should be allowed to have mobile numbering. Mobile numbering might not be wanted by VOIP service providers at present, because it creates expectations of unrestricted mobility and high tariffs. However, as VOIP handover techniques like those for UMA are adopted and mobile tariffs fall, mobile numbering could be used to suggest substitution of one service for the other. It would be even more effective in doing this if there were full mobile number portability. The use of the 3XY NDCs cannot be tied to particular mobile licence agreements or spectrum allocations, if regulation is to be neutral between introducing 'home zone' tariffs and deploying FMA with 'dual mode' terminals.

We note also that number portability could be easy to build into VOIP services from the beginning (though it might slow down market entry). It could be required to be implemented by VOIP service providers (and available on a reciprocal basis) if they were to use certain number ranges; then it might gradually spread through those ranges.

As indicated in Section 3.3 we are not at this stage advocating the use of any particular NDCs for non-geographic numbering for VOIP services; we think that the choice of NDCs will follow from deciding which information non-geographic NDCs should provide.

4.4 Recommendations for Colombia

We recommend:

1. Allowing all services to have geographic numbers provided that:
   - All calls to the numbers have call charges at or below those for the geographic tariff packages of the callers.
   - Any respects in which the services do not meet user expectations of traditional geographic services are clearly described to customers, both at the point of sale and in regular communications from the service providers.
2. Consulting the industry and consumer groups about numbering for converged services, dealing with, in particular:

- Whether VOIP service providers could reasonably be required to implement number portability if they are to gain access to certain number ranges.

3. Reviewing capacity demand trends annually.

5 Short codes

5.1 Experience in other countries

1XY short code space has usually been used for customer services provided by fixed access network operators (including fault reports, long distance operator services, directory enquiries and sales enquiries). In many countries it is also used for calling emergency services.

Without competition, the 100 short codes offered by 1XY are more than enough to meet all demands on them, so they have often been allocated liberally (sometimes to non-obvious applications such as airline bookings).

With competition, the pressure on the short code space has increased for two reasons:

- All access networks want their own set of customer service codes, equivalent to those enjoyed by existing access networks. When the same code is used for the same purpose on all access networks (with, for example, 104 for reporting faults on network A when using a phone connected to network A, and 104 for reporting faults on network B when using a phone connected to network B) this is relatively easily handled. (In Section 5.3 we discuss the only problem with doing this: access between networks needs to be provided, so that, for example, a fault on network A can be reported from a phone connected to network B.) In a system like that in Colombia, where a small group of existing operators have exclusive codes, competition can increase pressure on 1XY to breaking point.
- Short codes have become a favoured source for carrier selection codes; the shorter these are the more customers like them, but 3-digit codes consume the available space rapidly. (In Chile, for example, with over 50 alternative operators, more than half of the 1XY space is used in this way.)

Short code space is often seen as particularly suitable for international harmonisation efforts, because some of the functions that it offers (such as emergency assistance and directory enquiries) are often needed by travellers and because the same space may be available in different countries. For example:

- In Latin America the code 128 for emergency calls in Mercosur has been mentioned by Regulatel correspondents.
- In Europe the 11x range has been earmarked for harmonisation. In particular:
  - The code 112 for emergency calls is the most successful harmonisation initiative: it has been implemented everywhere in the EU (often in parallel with older, familiar, emergency codes) and is now known by 35% of the general public[42]. It has also been adopted widely in other countries, at least for GSM networks.
  - The code 118 (possibly extended to 118x, 118xx or 118xxx) is used for directory enquiries in several countries.
  - The code 116 (again extended) is now proposed to have more harmonised use for public service functions in the current European Commission Framework Review.
- In South Asia the codes 100, 101 and 102 have been recommended for emergency calls (for police, fire and ambulance respectively).

[42] See *E-Communications Household Survey* (Eurobarometer, July 2006) at http://ec.europa.eu/public_opinion/archives/ebs/ebs_249_en.pdf.

Many countries are developing their 1XY short code space in ways that assign a special significance to particular values of the X or Y digit. For example, carrier selection codes are often grouped together on one or two values of X. (In the US, X must be 0, as the 10x xxxx carrier selection code range is the only such range used.) Often the second digit of a short code (following the initial 1) is used to identify a particular class of short codes. Typical classes are:

- Codes for essential services, such as emergency calls, that must be the same on all access networks and must be provided by all access networks.
- Codes for common services, such as fault reports or directory enquiries, that must be the same on all access networks but need not be provided by all access networks. These codes can be further classified as follows:
  - Codes specifying call destinations on the access networks of the callers (for example, for directory enquiries, if the callers use directory enquiries on those access networks).
  - Codes specifying call destinations on other access networks (for example, for fault reports, if the callers are unable to use the faulty access networks).
  - Codes imposing call routing through specific trunk networks (in particular, for carrier selection) and therefore needing to be followed by phone numbers of call destinations.
- Codes for commercial services, such as football results, that need not be the same on all access networks and need not be provided by all access networks.

Short code space is regarded in some countries (such as the Netherlands) as a scarce resource that should be reserved for memorable codes for special services of public interest; typically new services need long numbers and would not qualify. The opposite view is taken in Australia, where most new services have short codes and rights of use of short codes are auctioned, with reserve prices and preferential treatment for charities.

5.2 The current position in Colombia

5.2.1 Existing allocations

Figure 8 shows the use of 1XY codes in Colombia in early 2005[43].

	0	1	2	3	4	5	6	7	8	9
0	Operadora local extendida	Reclamos Aseo				Operadora Información LDN		Operadora Información LDN		Operadora Información LDN
1	Operadora local extendida	Atención de Desastres				Operadora Nacional		Operadora Nacional		Operadora Nacional
2	Operadora local extendida	Policía	Fiscalia	Cruz Roja	Procuraduria	Fuerzas Armadas			Información TPBCL-Operador 2	
3	Operadora local extendida	Directorio por operadora - TMC y PCS	Número Unico Nacional de Emergencias	Instituto de los Seguros Sociales ISS	Personeria	Departa-mento Administra-tivo de Seguridad DAS			Daños Telefónicos TPBCL - Operador 2	
4		Daños Telefónicos TPBCL - Operador 1	Reclamos TMC - Red A	Reclamos TMC - Red B	Defensa Civil	Servicio de Desmovil-ización de los grupos ilegales alzados en armas	Daños Gas		Información TPBCL-Operador 3	
5		Daños Energia	Secretaria de Salud - Ambulancia				Anti-secuestro, anti-terrorismo y antiextorsión		Daños Telefónicos TPBCL - Operador 3	Proyectos Especiales de Entidades Territoriales
6	Denuncia maltrato a la infancia	Daños Acueducto	Tránsito departa-mental		Asistencia de Emergencias - Fuerza Militares	CAI - Policia Nacional	Inteligencia Policia Nacional		Información TPBCL-Operador 4	
7		Servicio de Información hora	Tránsito municipal	Información Hospitalaria	Anti-secuestro, anti-terrorismo y anti-extorsión	DIJIN	Información de actividades de tráfico, comercial-ización y consumo de narcóticos	Información TPBCL-Operador 1	Daños Telefónicos TPBCL - Operador 4	
8	Información celular red A	Información PCS	Reclamos PCS			Operadora Información LDI		Operadora Información LDI		Operadora Información LDI
9	Información celular red B	Bomberos				Operadora Inter-nacional		Operadora Inter-nacional		Operadora Inter-nacional

Pink: Modalidad 1: Free calls for emergencies and so on.
Pale Yellow: Modalidad 2: Free calls.
Dark Yellow: Modalidad 2: Free calls to an identified operator.
Blue: Modalidad 3: Locally tariffed calls.
Orange: Modalidad 4: Specially tariffed calls for services of social interest.

Figure 8 Use of 1XY space in 2005

[43] See *Borrador Resolución 113* (CRT, October 2005) at http://www.crt.gov.co/Documentos/ActividadRegulatoria/ServiciosInformacion/ProyectoResolucion_051012.pdf.

Figure 8 shows that:

- Codes do not seem to be chosen systematically. Though the codes can be classified in several ways, two of which are shown in Figure 8 (charging modality and operator exclusiveness), there appear to be few patterns that could help users to recognise the likely uses of codes.
- One clear pattern is in the similar uses of the codes 1X0, 1X1, 1X8, 1X9 by the three long distance operators Orbitel (X = 5), 007 Mundo/ETB (X = 7), and Colombia Telecommunicaciones (X = 9). (This pattern is laid down for all 1XY short codes with X=5, X=7 or X=9 in Decree 25 of 2002, but it is not adhered to except when Y=0, Y=1, Y=8 or Y=9 and is contradicted in Resolution 664 of 2003.) Unfortunately, this pattern cannot be extended to an indefinite number of new long distance operators.
- Besides the 12 operator-specific codes just mentioned, another 14 are allocated to a specific operator, making 26 such codes in all.
- 30 codes are allocated to non-telecommunications uses: 14 codes appear to relate to different types of emergency assistance, 13 to other community services, and 3 to complaints about utilities (gas, electricity and water).
- Two codes are allocated for shared applications related to telecommunications (117 for the time and 113 for directory enquiries), and four (100, 101, 102 and 103) are available to operators offering extended local service.
- 38 codes are free. One of these (130) has been identified for directory enquiries by CRT.
- There appears to be some scope for rationalising the uses. For example, 147 and 165 seem to have identical purposes (though one is for the police and one is for the army). There are so many emergency numbers that users might dial the wrong ones in their confusion and anxiety: having one central number from which calls would then be passed to the relevant services could be faster and safer.
- The short codes having charging modality 3 relate to non-telecommunications uses (emergency assistance and other community services). However, not all short codes relating to non-telecommunication uses have charging modality 3. Users may be puzzled about whether charges will be applied.
- At present there is no non-geographic NDC having the same tariff regulation as short codes having charging modality 3.
- There are only two short codes with charging modality 4. One of these (113) is to be changed and, in effect, moved to a new charging modality (so there will be only one short code with charging modality 4). Because 113x and 130x will be effectively new short codes, with new lengths, the new charging modality may not increase the confusion of users.
- Neither 128 nor 112 can currently become a short code for all emergency calls. Resolution 664 of 2003 allocates 123 for a similar purpose.

In their contributions to this study operators remarked that:

- Allocating just one 1XY code per access network operator or long distance operator would be equitable.
- Short codes for particular operators should be limited in number, so that new entrants could compete with existing operators.
- Asymmetries between fixed and mobile access network operators should be removed, perhaps especially where they relate to the numbers of short codes allocated.

- There are too many poorly positioned short codes, so they are hard to remember.
- The relations between the short codes, charging and routing have too many cases and are difficult to manage.

5.2.2 Utilisation

Information supplied to this study by operators indicates that in general:

- Calls to 1XY codes are under 2% of all calls originating on the reporting networks.
- Few codes account for a high proportion of all calls to 1XY codes. Typically, the most popular 6 to 8 codes account for more than 70% of calls to 1XY codes on each network.
- 113 (directory enquiries) is the most popular code on all the reporting networks. 117 (time) and 115 (electricity fault reports) are also widely used.
- The most-used operator-specific codes are generally those for providing local and national information.
- Many 1XY codes appear to be so little used that they could be withdrawn (or replaced by full-length numbers) without major effects on the public or on the body receiving the calls.
- All 1XY codes are less used on mobile phones than on fixed phones.

5.3 Options in Colombia

However few new market entrants there are, they are unlikely to fit well in the existing short code space. Considerations of equity and of long term convenience for users point to adopting a new policy whereby each operator would have at most one 1XY code, allocated exclusively to itself and (for long distance operators) preferably aligned with the carrier selection codes. (Thus the three current long distance operators might use 150, 170 and 190 if these short codes resembled their new carrier selection codes enough.) Operators wanting to offer more than one service using this code would be able to use it with 4 or even 5 digits (though the use of 5 digits would require a change in the regulations) or as the entry point to an Interactive Voice Response (IVR) system that would offer various options. Calls to the code would be free. (The general principles of tariff transparency should apply to short codes as they apply to E.164 numbers; in particular, short codes should ideally signify the tariffs, just as NDCs should, unless users are warned in messages announced or displayed before calls.)

Customers would also benefit from having a set of common service codes for parallel use by all fixed and mobile access network operators and numerical identifiers for the operators. (These identifiers would ideally be the same as those used in carrier selection codes for access network operators acting as long distance operators and in directory enquiry short codes for access network operators acting as directory enquiry service providers.) For example, the single code 104 could be used by all access network operators for fault reporting on their own networks and the numerical identifier 75 could identify network A. Fault reports about network A made from network B might be made by:

- Dialling 104 and expecting manual onward routing of such calls, by agreement among operators: the human operator receiving the call to 104 on network B would connect the call through to the human operator on network A.
- Dialling a compound short code such as 175 104 that identifies network A and the nature of the call (a fault report), as is done in El Salvador, for example.

- Dialling a non-geographic E.164 number such as 800 104 0075 that identifies network A and the nature of the call (a fault report), where, if desired, a special 8XY NDC could be set aside for use in numbers at less than full national length.

Given the shortage of vacant short codes the first of these may be the most realistic, as it does not require the numerical identifiers for access network operators. (These numerical identifiers should not be confused with the NDCs occupied by the access network operators, as these NDCs may be shared between operators, especially if there is number portability.)

Short code space is inaccessible using long distance national and international dialling procedures for Colombia, because of the duplication between 1XY short codes and numbers for NDC 1. However, if short codes were allocated and tariffed suitably there could be systematic ways of transforming them into national numbers that (in principle) could be dialled nationally and internationally; for example, the short code 119XYZ might be transformed to the non-geographic number 900 119 XYZ0, where in both case the use of 9 would signify a particular tariffs. (Such transformations may be useful for national dialling even if they are not useful for international dialling.)

If, as we suggest very tentatively in Section 8.3, there should be an automatic transformation of short codes on mobile phones into short codes on fixed phones, suitable short code space must be allocated to this. Currently the 13Y range looks most suitable, because if short codes for mobile phones began with 8 or 9 to signify particular tariffs the vacant short codes could be used to extend short codes on mobile phones to longer short codes on fixed phones (if the regulations about short code lengths were amended).

However, at present we cannot suggest a new structure for the short code space. It will depend on which codes can be retrieved from their current holders. For example, there is currently most spare short code space in the 16Y range, so that range could be used preferentially for a particular purpose (such as carrier selection, if carrier selection codes were to use the 1XY range) and would eventually be dedicated to that purpose. However, if public authorities were to give up some current short codes, a different range (such as 14Y) might be preferred for that purpose.

Local dialling space in 9xx xxxx ranges other than 90x xxxx, 91x xxxx, 92x xxxx and 93x xxxx is vacant. It could be used for short codes or carrier selection codes. However, in Section 2.3 we propose (and prefer) an alternative use for it, in the process for expanding geographic numbering space. If there is a justifiable strong demand for short numbers, suitable non-geographic numbering ranges, with suitable NDCs, could be used for numbers that have fewer than 10 digits, as noted in Section 3.3.

5.4 Recommendations for Colombia

We recommend:

1. Requesting from all operators figures for the utilisation of each short code.
2. Reviewing with the sponsoring public organisation of each short code the meaning, treatment of answered calls and continuing value of the short code.
3. Imposing strict requirements (such as essential relevance to safety, minimum levels of utilisation, uses related to telecommunications or uses unsuitable for just E.164 numbers) to justify obtaining or retaining short codes.
4. Consulting the industry and consumer groups about the short code space structure, dealing with, in particular:
   - Whether having most one 1XY code per operator would be feasible.

- Which other short codes should be used for which purposes in a restructured short code space.
- Which short codes should be in a set of common service codes for parallel use by all fixed and mobile access network operators.
- What other harmonisation between short codes on fixed and mobile phones (including those using * and #) would be feasible.
- Whether an automatic transformation taking short codes into non-geographic E.164 numbers would be useful.
- Whether delegated management of short codes, within the overall national numbering plan, would be desirable.

5. Introducing incentives to utilising short codes well, such as:
   - Imposing levels of charging for obtaining and retaining short codes.
   - Abolishing charging modality 3 (thereby also improving tariff transparency).

6 Carrier selection

6.1 General aspects

6.1.1 Preselection and call-by-call selection

When customers can choose long distance operators, their access networks need to be told about that choice in order to route long distance calls correctly[44]. There are two basic ways to do this using single-stage call set-up[45]:

- **Preselection**. The customer makes a lasting choice of operator for all long distance calls (or possibly more than one, for different types of call). The access network operator stores this choice in the line record of the customer and the exchange automatically takes into account this record for every relevant call made by the customer.
- **Call-by-call selection**. The customer signals his choice of operator to the access network for each call, by adding or changing dialled digits.

The two are often combined into preselection with override, where customers make their own lasting default choices but can still select different operators for particular calls by dialling appropriately.

Preselection is often the more complex option to implement, because it requires more agreements and procedures between operators[46]. However, with the override facility, it has become the solution of choice in most advanced countries because:

- It simplifies and shortens dialling.
- It ensures equal treatment for all competitors.
- Customers typically prefer to think about their choices of operator less frequently than for every call.

If preselection is widely used, carrier selection codes become less critical, because they are only dialled occasionally. If preselection is not available, and customers must dial extra digits to choose operators for all long distance calls, then the number of extra digits to be dialled becomes important.

Various details need to be determined before preselection and call-by-call selection can be adopted. Customers may not consciously select long distance operators, in which case the default embedded in the regulation can help either incumbents or new entrants. For example:

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[44] In this report operators are not assumed to own or control networks; for carrier selection, in particular, they could be resellers, as is allowed for in the regulations in Colombia.

[45] In single-stage call set-up, the caller dials the called number, perhaps with a prefix or carrier selection code. In double-stage call set-up, the caller dials an access number and then enters the called number, perhaps along with an authorisation code. Double-stage call set-up is much more cumbersome than single-stage call set-up and cannot be argued to offer fair conditions to new entrants. However, if it requires an authorisation code it remains a widespread alternative for use with calling cards and public phones, as payment is independent of the calling line identity.

[46] In some countries preselection has also been seen as too technically demanding and as requiring advanced exchange capabilities that are not always present. This is unlikely to be problematic in most parts of Colombia. However, management systems may cause problems: dominant operators that have both access and long distance networks often find difficulties in adapting their provisioning and other processes to accommodate other operators. Implementing preselection may therefore require new releases of software and take at least a year,

- In Finland and the US, calls dialled without carrier selection are allocated randomly among operators in proportion to all selections made deliberately. Typically this benefits new entrants.
- In Australia, calls dialled without carrier selection are allocated to the incumbent.
- In most countries, calls dialled without carrier selection are allocated to the long distance operator chosen by the access network operator. Usually this benefits incumbents, but it may benefit new entrants and has therefore been favoured during the development of mobile access networks.

Other details can also influence the effect of preselection on competition, such as the method of getting customers and the attitude to the incumbent. For example[47]:

- In Peru operators got customers for preselection by door-to-door selling. During 2 years from the introduction of preselection, new entrants gained about 20% of long distance international traffic, traffic volumes were unchanged and prices were unchanged. Traffic volumes then fell by 10% over 6 months, while prices rose by 10%. Then call-by-call selection was introduced using 19XY carrier selection codes; in 1 year new entrants gained a further 10% of long distance international traffic, traffic volumes rose by 50% and prices fell by 20%.
- In Mexico operators got customers for preselection in a ballot[48]. In 1 year new entrants gained 30% of long distance national traffic. (In fact they originally gained a higher proportion than that; however, in both Peru and Mexico the incumbent had recently raised line rentals, which may have made customers willing to punish the incumbent by changing supplier but which also gave the incumbent cash for competing on call charges.)

6.1.2 Procedures for call-by-call selection

There are three widespread dialling procedures for call-by-call selection:

- **Prefixing**. The customer dials a carrier selection code before any national or international prefix and before the rest of the number. Any free short code range can be used for carrier selection codes; the most common choices are 10xxx and 1xxx. For example, from the UK a customer of Superline could dial 1461 00 57 1 964 0235 to reach a phone in Bogotá (using 1461 as the carrier selection code).
- **Substitution**. The customer dials a carrier selection code instead of any national or international prefix and before the rest of the number. For example, from France a customer of Neuf Cegetel could dial 90 57 1 964 0235 to reach a phone in Bogotá (using 90 as the carrier selection code).
- **Insertion**. The customer dials a carrier selection code after any national or international prefix and before the rest of the number. For example, from Hong Kong a customer of

[47] See *Stocktake of progress toward the key elements of a fully liberalised telecommunications sector in the APEC region* (APEC, June 2004) at http://www.apec.org.au/docs/stocktake.pdf.

[48] In a ballot, as performed in Australia, Mexico and the US, customers were sent a ballot paper to which they responded by selecting a service provider. In Australia customers might be sent a second ballot paper if they did not respond to the first, at least in areas where the response rate was less than 60%. Previous experience in the US suggested that customers should be sent the ballot paper on its own: the use of bill inserts produced a response rate of only 30%. Ballots are not cheap, so recovering their costs can be contentious. They may be appropriate mainly when competition is first introduced. In Canada they were rejected by the regulator, CRTC, because competition had already developed and advertising would be effective. They are not used in Australia now.

New World Telecommunications could dial 00 9 57 1 964 0235 to reach a phone in Bogotá (using 9 as the carrier selection code).

All three procedures are found in Latin America: the first is found in Peru, the second is found in Argentina and Mexico, and the third is found in Brazil. The procedure in Colombia could be regarded as being substitution (with no national or international prefix and with carrier selection codes 05, 07, 09, 05, 005, 007 and 009) or as insertion (with national and international prefixes 0 and 00 and with carrier selection codes 5, 7 and 9); Decree 25 of 2002 effectively regards the procedure as substitution, in speaking of long distance national and international prefixes as comprising 0 or 00 followed by the carrier identification code[49].

6.2 Experience in other countries

In the world as a whole the most common choices for preselection and call-by-call selection have preselection with recommended ITU-T national and international prefixes (0 and 00) and with 1X, 1XY or 1XYZ prefixes for override[50]. The UK provides an example of this practice that is worth examining briefly because preselection became popular there even though call-by-call selection had already been available for many years.

Three countries (France, Singapore and Hong Kong) have had transitions from oligopoly to open competition that are similar to the one that Colombia now faces, and their experience may be interesting in Colombia. For example, in France carrier selection codes do not always start with 0 or 1, and in Singapore and Hong Kong carrier selection codes can be regarded as following more than one dialling procedure.

6.2.1 UK

Long distance competition in the UK started in 1984, but before 1998 used only call-by-call selection without preselection. The UK continued to resist introducing preselection until obliged to introduce it by the European Commission. The obligation to provide preselection only applies to the incumbent: all other access providers are regarded as non-dominant for this purpose. The incumbent argued, and the regulator, Oftel (at that time), agreed, that the competition provided by call-by-call selection was enough, and the extra cost of introducing preselection was not justified. (With auto-diallers on customer premises, alternative service providers could use call-by-call selection to achieve much the same effect as preselection.)

In fact preselection has proved popular with UK customers, who tend to prefer simple dialling patterns. Customers using carrier preselection have risen from 0 in 2001 to over 6 million in 2006[51].

Nonetheless there is still demand for call-by-call selection, through the use of either carrier selection codes (with up to 5 digits) or non-geographic numbers offering double-stage set-up. Currently there are more than 400 short codes allocated for purposes that might include call-by-call selection. (Service providers sometimes offer different tariffs or service features on different codes.)

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[49] In this report the Carrier Identification Code (CIC) is distinguished from the Carrier Selection Code (CSC). The CIC identifies the operator. The CSC includes the CIC but also indicates that a CIC is present; typically it precedes the CIC with extra digits.

[50] See *Dialling procedures (international prefix, national (trunk) prefix and national (significant) number) (in accordance with ITU-T Recommendation E.164 (05/97)) (Position on 1st January 2005)*, ITU Operational Bulletin 827 Annex (ITU, January 2005) at http://www.itu.int/itudoc/itu-t/ob-lists/op-bull/2005/827.html.

[51] Part of this increase is due to combined line-and-calls packages offered by companies that resell BT lines as their own, together with carrier preselection.

6.2.2 France

From 1996 France had a closed 9-digit numbering plan, plus the standard ITU-T national prefix 0 as another, initial, dialled digit. When the French market first opened to competition in 1998, this first dialled digit was used for carrier selection. From 2000, preselection was also introduced, with the value 0 signifying the default operator (which for customers who had not chosen otherwise was normally France Télécom). In addition, the short code range 16YZ was made available for carrier selection codes. Currently 35 of these 4-digit 16YZ prefixes are assigned.

The 1-digit prefix allocations had a duration of 15 years. To qualify for a 1-digit prefix, operators had to accept certain obligations[52]. Originally, demand for this resource exceeded the limited supply and the lucky operators were chosen by drawing lots. Some 1-digit prefixes have since been returned to the regulator; only four values are currently allocated. These are 4, 7, 8 and 9, allocated respectively to Télé 2, Cegetel, France Télécom and Neuf Telecom[53]. Monitoring compliance with the interconnection obligations, and negotiating changes in them, has proved quite burdensome.

All numbering resources in France attract charges at rates related to the amount of numbering space taken up (that is, the shorter the code, the higher the charge). Accordingly, along with other 4-digit codes, 16YZ codes are currently charged to operators at €40,000 a year, and the 1-digit codes at €400,000 a year.

Preselection has proved popular in the French market: in 2005 over 6 million lines had taken it up and this number was growing at 19% a year, while under 3 million were using call-by-call selection with this number falling at 8% a year.

A consultation in 2004 led to the regulator deciding not to issue any more 1-digit prefixes, and to review the position in 2013 when the current 1-digit prefix allocations expire. Industry opinion on the whole favours withdrawal of the 1-digit prefixes in 2013, so that they can be put to alternative uses. These prefixes still confer an advantage on the companies that possess them (which some regard as unfair), but this advantage becomes ever less significant as preselection gains ground and call-by-call selection declines.

In 2005, after considering the supply of, and demand for, 16YZ codes, the regulator decided to relax its restriction on 16YZ codes from one code per operator to two codes per operator. (Operators might want more than one code in order to offer more than one quality of service, as was the case in India, or to offer more than one tariff, expecting that customers will find a code that fits their calling patterns well and then select it for all calls.)

6.2.3 Singapore

In Singapore, long distance national and international dialling are identical, as Singapore itself is a small island with a closed 8-digit numbering plan and all domestic calls are local.

There are two kinds of international dialling prefix incorporating carrier selection:

- 0XY (among them being the preselection default prefix 000): 18 of these have been allocated, all with X in the range 0 to 3, to five different operators. (SingTel has 8 of these and StarHub has 7.) To be eligible for 0XY codes, licensees must have their own

[52] These obligations included providing a certain number of points of interconnection per region to a specified timetable with transmission capacity owned by the operator. See *Decision 97-0196* (ART, July 1997) at http://www.art-telecom.fr/uploads/tx_gsavis/97-196.pdf.

[53] Cegetel and Neuf Telecom became one company, Neuf Cegetel (with brand name ‘n9uf cegetel’), in 2005, after the consultation on what should be done with the 1-digit prefixes. This company is a successor to 9 Telecom, which was named after its code.

infrastructures, commit to an overall investment in infrastructure of at least S$150 millions over 3 years from the date of licensing, and use the access codes to provide service for the mass consumer market.

- 15YZ: 27 out of these 100 have been allocated. Resellers are eligible for 15YZ codes, to which they may append one digit for indicating other services besides international dialling.

Allocation procedures for both types of codes involve classifying the available codes as more or less desirable[54]. More desirable codes are auctioned whilst less desirable codes are allocated by drawing lots[55].

6.2.4 Hong Kong

As in Singapore, long distance national dialling is irrelevant in Hong Kong (although the simple prefix 0 has been reserved to allow for possible integration with Chinese long distance national dialling).

Again, there are two kinds of international dialling prefix incorporating carrier selection:

- 00Y or 00YZ (among them being the preselection default prefix 001): 4 of the 00Y codes and 3 of the 00YZ codes have been allocated, all to fixed access network operators.
- 15YZ and 16YZ: 113 out of these 200 have been allocated.

6.3 The current position in Colombia

6.3.1 Utilisation

Information supplied to this study by operators indicates that in general:

- Calls using the prefix 03 are several times more common than calls using the prefix 01.
- Calls using long distance national carrier selection codes (05, 07 and 09) are several times more common than calls using long distance international carrier selection codes (005, 007 and 009).

In fact over 80% of calls originating on fixed access networks use local dialling, without prefixes or carrier selection codes but over 90% of calls originating on mobile access networks are mobile-to-mobile calls.

6.3.2 Existing regulations

In Colombia three long distance operators have short call-by-call selection dialling arrangements of a kind which cannot be extended to many others. Decree 2926 of 2005 contains two provisions:

> **Artículo 5. Numeración para acceder al servicio de Larga Distancia:** Los operadores establecidos de Telefonía Pública Básica Conmutada de Larga Distancia tienen derecho a preservar su prefijo interurbano e internacional con el cual han venido prestando su servicio, mientras conserven su condición de operador habilitado, bajo las condiciones establecidas por la Comisión de Regulación de Telecomunicaciones.

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[54] For full versions of the rules in annexes to the numbering plan see *Annex 1 - Procedure & Criteria for Assigning 3-Digit Access Codes* (IDA, August 2006) at http://www.ida.gov.sg/idaweb/doc/download/I476/Annex_1_1.pdf and *Annex 2 - Procedure for Assigning 4-Digit Access Codes* (IDA, August 2006) at http://www.ida.gov.sg/idaweb/doc/download/I476/Annex_2_1.pdf.

[55] In Singapore these lotteries are called “ballots”, though they are not what others would call “ballots”.

Artículo 9. g) Libre elección del operador por multiacceso: Todos los usuarios de los servicios de telecomunicaciones, tendrán derecho a acceder a los servicios de Telefonía Pública Básica Conmutada de Larga Distancia de cualquiera de los operadores que presten dicho servicio, en condiciones iguales, a través del sistema multiacceso utilizando un prefijo o la numeración de servicios durante la marcación.

Article 5 guarantees the existing operators continuing use of their short prefixes for the durations of their concessions (though presumably CRT can vary the conditions of this use). Article 9 gives users (or possibly operators) conditions of equal access. However, the draft Free Trade Agreement requires dialling parity, but this requirement can only be fulfilled for at most four new long distance operators without replacing the existing carrier selection codes.

To date, preselection has not been offered in Colombia. (However, the prefixes 01 and 03 already imply that the long distance operators are chosen by the access network operators for certain call types.) While the term 'multiacceso' has been used customarily to mean call-by-call selection among all available operators, the relevant regulations do not appear to mention preselection and we believe that 'multiacceso' could be extended to include preselection (though, of course, we are not expert in how laws are interpreted in Colombia).

In their contributions to this study operators suggested that:

- Preselection should be provided to achieve 'multiacceso'.
- Auctions of codes can result in higher costs.
- The current long distance operators have invested in public understanding of their dialling arrangements, which in some cases are important for brand awareness.
- Changing existing carrier selection codes would be expensive for the operators and inconvenient for the users.

6.3.3 ITU-T recommendations

The current scheme for carrier selection codes in Colombia does not conform fully with two sections of ITU-T recommendation E.164:

7.3.2 Prefijo nacional (interurbano)

El prefijo nacional (interurbano) no está incluido en el N(S)N. En consecuencia, en el servicio internacional no deberá marcarse el prefijo nacional (interurbano) del país de destino.

Debe señalarse que en algunos países suele considerarse, para fines nacionales, que el prefijo nacional (interurbano), que no es entonces el N(S)N, está incluido en el plan de marcación nacional. Por lo tanto, habrá que distinguir cuidadosamente entre esa definición o práctica nacional y la definición del UIT-T, que es válida en el plano internacional. Para evitar toda incertidumbre, la definición del UIT-T incluye entre paréntesis la palabra "significativo" y se lee "número nacional (significativo)".

El UIT-T recomienda al administrador del plan de numeración nacional de los países que no hayan adoptado todavía un prefijo interurbano para el acceso a su red interurbana automática nacional, que adopten un prefijo constituido por una sola cifra, de preferencia el cero. Cualquiera que sea la cifra adoptada como prefijo interurbano, conviene asegurarse de que esta cifra no pueda utilizarse también como primera cifra del N(S)N.

12 Prefijo internacional

El UIT-T recomienda que los administradores de planes de numeración nacionales de los países que todavía no hayan introducido el funcionamiento internacional automático, o los administradores de planes de numeración nacionales y los operadores de redes internacionales que, por diversos motivos, están definiendo o revisando sus planes de numeración, adopten un prefijo internacional (un código de acceso a la red automática internacional) compuesto de las dos cifras 00.

These sections are often interpreted to recommend that the national or international prefix (0 or 00) should directly precede the NSN or ISN, so that in turn any carrier selection code should precede the national or international prefix. (Among the people interpreting the sections in this way are ITU officials close to Study Group 2, which is responsible for E.164.)

6.4 Options in Colombia

With market opening, if call-by-call selection is kept there will need to be more carrier selection codes, and experience elsewhere suggests that four more will not be enough. (In Argentina, for example, there are 112 long distance operators, so operators are identified by 3-digit carrier identification codes.) Abandoning call-by-call selection would not help market entrants, as they would then need to delay entry until the provisioning and other processes for preselection had been devised, implemented, tested and approved.

The number of carrier selection codes needed is particularly high if resellers are among the operators that may be allocated them. Decree 2926 of 2005 requires resellers to use specially tariffed numbers with double-stage call set-up. However, convenience for users and competition between operators would be enhanced if resellers were allowed to offer single-stage call set-up. If resellers were allowed to offer single-stage call set-up, they might be allocated only carrier selection codes that were longer than the carrier selection codes allocated to operators satisfying very demanding requirements (on investment in infrastructure, for example); doing this would not provide full dialling parity but would match the accepted practice in various other countries.

Thus call-by-call selection must be extended to an unknown number of operators. Doing this will generally require longer carrier selection codes, which burden users and which encourage users to continue using any operators that have short carrier selection codes. Introducing preselection while keeping call-by-call selection has two potential benefits:

- It reduces the burden of longer carrier selection codes on users. If callers in Colombia like preselection, then the lengths of carrier selection codes will become less important (as in France).
- It could be used differentially to offset the advantage gained by any operators that have short carrier selection codes. (For example, they might be required to let their access network customers use preselection and might not be allowed to offer preselected long distance service to the access network customers of other operators.)

Letting the existing operators keep short carrier selection codes is likely to lead to objections from new entrants; it might, however, be acceptable if combined with a pre-specified transition timetable, which could be tied to concession renewal[56].

The approaches to call-by-call selection that we consider here all provide more carrier selection codes. They differ in whether they retain existing carrier selection codes, introduce new carrier selection codes as short as existing ones, and position the national and international prefixes after the carrier selection codes. Figure 9 characterises some of these options, with examples. It shows that options 2, 3, 5 and 6 are unsatisfactory for competition. Overall, options 1 and 4 have most merits. However, none of the options can be rejected yet.

In these options we have assumed that there must be a possibility of at least 100 carrier selection codes. Implementing this possibility usually involves introducing longer carrier selection codes. We have assumed that these longer carrier selection codes are allocated only after the shorter ones have been exhausted; doing this is unfair on the later arrivals

[56] Concessions are often made for renewal after 10 years, which may be due soon. ETB, for example, obtained a concession in 1998.

among the new entrants but may help to promote early use of, and investment by, competitive services providers. The additional carrier selection codes and capacities are shown in Figure 9 enclosed by [and]. Evidently they are very likely to be required by option 3 and much less likely to be required by option 1.

In general options 1, 2 and 3 require longer carrier selection codes earlier than options 4, 5 and 6 because they need to reserve a sequence (chosen to be 02 in this report) as an escape from shorter carrier selection codes. (However, the average numbers of dialled digits might still be lower for options 1, 2 and 3 than for options 4, 5 and 6.) In fact options 4, 5 and 6 might never require longer carrier selection codes, if they also used carrier selection codes that start with 1XY. The use of carrier selection codes that start with 1XY can increase the capacities of the options but is ignored in Figure 9.

Another way of increasing the capacities of the options is to replace 01 by 03 or 03 by 01, so that 01 or 03 can then be used to start carrier selection codes. (This way of increasing the capacities is also ignored in Figure 9.) The current distinction between 01 and 03 seems unhelpful to us; for example, the use of 01 3xx xxx xxxx instead of 03 3xx xxx xxxx could indicate that mobile call charges applied and would be uniform with the use of 01 8xx xxx xxxx and 01 9xx xxx xxxx. If either 01 or 03 is to be replaced by the other, the following factors are relevant:

- The use of 01 instead of 03 matches conventional international expectations better (though, of course, the use of 0 instead of both 01 and 03 would do this better still).
- The use of 01 instead of 03 provides a uniform sequence (02, 03, 04, 05, 06, 07, 08 and 09) for starting carrier selection codes.
- The use of 03 instead of 01 matches the current dialling pattern that occurs most frequently when prefixes are used.
- The use of 03 instead of 01 avoids changing address books on mobile phones (which are more widespread than address books on fixed phones).

Just using carrier selection codes that start with 1XY (instead of ones that start with 0XY) would have a different advantage: the 01 and 03 prefixes could be eliminated entirely. Doing this would let national and international dialling with preselection use just the recommended ITU-T national and international prefixes (0 and 00) directly followed by the NSN or ISN. It would also increase the appeal of preselection to users. The use of carrier selection codes that start with 1XY is a widespread practice in other countries; it would become feasible in Colombia if enough 10Y short codes, say, could be retrieved and extended. Whether this could be done should become apparent after discussions with existing holders of short codes. It is not assumed to be feasible in Figure 9.

Option	Digits dialled before NSNs or ISNs	Number of digits dialled before NSNs or ISNs	Examples of digits dialled in complete numbers	Protection of brands of existing operators	Fairness to new operators	Conform-ance with inter-national standards	Number of operators supported
.: Extended current ıational CSCs and new 3-digit national CSCs, vith different ıternational CSCs	National: 01, 03, 0X'Y [, 02XY] International: 00X'Y [, 002XY] (X' = 4, 5, 6, 7, 8, 9)	National: 2, 3 [, 4] Inter-national: 4 [, 5]	National: 075 1 964 0235 Inter-national: 0075 379 853 1346	Good	Good	Limited	60 [+ 100]
:: Existing current ıational CSCs and new 3-digit national CSCs, vith different ıternational CSCs	National: 01, 03, 0X', 0X"Y [, 02XY] International: 00X', 00X"Y [, 002XY] (X' = 5, 7, 9) (X" = 4, 6, 8)	National: 2, 3 [, 4] Inter-national: 4 [, 5]	National: 066 1 964 0235 Inter-national: 066 379 853 1346	Perfect	Bad	Limited	33 [+ 100]
3: Existing current ıational CSCs and new 2-digit national CSCs, vith different ıternational CSCs	National: 01, 03, 0X' [, 02XY] International: 00X' [, 002XY] (X' = 4, 5, 6, 7, 8, 9)	National: 2 [, 4] Inter-national: 3 [, 5]	National: 06 1 964 0235 Inter-national: 006 379 853 1346	Perfect	Good for the lucky few but bad for the others	Limited	6 [+ 100]
4: Extended current ıational CSCs and new 3-digit national CSCs, vith identical ıternational CSCs	National: 01, 03, 0XY0 [, 0XYZ0] International: 0XY00 [, 0XYZ00] (X = 0, 2, 4, 5, 6, 7, 8, 9) (Y not 0) (Z not 0)	National: 2, 4 [, 5] Inter-national: 5 [, 6]	National: 0750 1 964 0235 Inter-national: 07500 379 853 1346	Excellent	Excellent	Extensive	72 [+ 81]
5: Existing current ıational CSCs and new 3-digit national CSCs, vith identical ıternational CSCs	National: 01, 03, 0X'0, 00X'0, 0X"Y0 [, 0XYZ0] International: 0X'00, 00X'00, 0X"Y00 [, 0XYZ00] (X' = 5, 7, 9) (X" = 2, 4, 5, 6, 7, 8, 9) (Y not 0) (Z not 0)	National: 2, 3, 4 [, 5] Inter-national: 4, 5 [, 6]	National: 0660 1 964 0235 Inter-national: 06600 379 853 1346	Perfect	Bad	Extensive	69 [+ 81]
6: Existing current ıational CSCs and new 2-digit and 3-digit ıational CSCs, with dentical international CSCs	National: 01, 03, 0X'0, 00X'0, 0X'Y0 [, 0XYZ0] International: 0X"00, 00X'00, 0X'Y00 [, 0XYZ00] (X' = 2, 4, 5, 6, 7, 8, 9) (Y not 0) (Z not 0)	National: 2, 3, 4 [, 5] Inter-national: 4, 5 [, 6]	National: 060 1 964 0235 Inter-national: 0600 379 853 1346	Perfect	Good for the lucky few but bad for the others	Extensive	77 [+ 81]

Figure 9 Comparison of carrier selection code options

In more detail the options in Figure 9 are as follows:

1. **Extended current national CSCs and new 3-digit national CSCs, with different international CSCs**. This option extends 05, 07 and 09 with an extra digit (making them 050, 070 and 090 or 055, 077 and 099, for example) and uses 04Y, 06Y and 08Y (and eventually 05Y, 07Y and 09Y, with the further possibility of 02YZ, if required) for all new entrants. The carrier selection codes for international calls continue to differ from those for national calls by having an extra 0 at the start.

   This option adds one digit to call-by-call selections. However, it provides dialling parity for many competitors while preserving the essence of the branding by existing operators. Extending 05, 07 and 09 would be best done with a period of perhaps 6 months for parallel running of the old and new codes; if they were extended to 050, 070 and 090 this could be done at any time, but if they were extended to 055, 077 and 099 it would need to await a geographic numbering change.

   Further codes could use 03Y (if the default prefix 03 had been replaced by 01).

2. **Existing current national CSCs and new 3-digit national CSCs, with different international CSCs**. This option leaves 05, 07 and 09 as they are and uses 04Y, 06Y and 08Y, with the further possibility of 02YZ, if required, for all new entrants. The carrier selection codes for international calls continue to differ from those for national calls by having an extra 0 at the start.

   This option does not disturb current dialling habits. However, it discriminates against new entrants. To make it acceptably fair, the existing long distance operators would need to fulfil special obligations, such as making a balancing payment or satisfying the differential requirements for preselection mentioned above.

   Further codes could use 03Y (if the default prefix 03 had been replaced by 01).

3. **Existing current national CSCs and new 2-digit national CSCs, with different international CSCs**. This option leaves 05, 07 and 09 as they are, uses 04, 06 and 08 for some new entrants, and uses 02YZ for all other entrants. The carrier selection codes for international calls continue to differ from those for national calls by having an extra 0 at the start.

   This option does not disturb current dialling habits. However, it discriminates against new entrants and needs to be accompanied by special obligations on at least the existing long distance operators. This option is most similar to the one used in France, Singapore and Hong Kong, and, as there, would probably make operators satisfy qualifying requirements if they were to be allocated a limited resource (04, 06 or 08). The qualifying requirements would need to be made very demanding if no more than 3 potential competitors were to satisfy them; otherwise another ‘fair’ allocation mechanism (such as a beauty contest, an auction or a lottery) would be needed instead or as well.

   Further codes could use 03Y (if the default prefix 03 had been replaced by 01).

4. **Extended current national CSCs and new 3-digit national CSCs, with identical international CSCs**. This option extends 05, 07 and 09 to 005, 007 and 009 and uses 0X2, 0X4, 0X6 and 0X8 (and eventually 0X5, 0X7 and 0X9, with the further possibility of 0XYZ, if required) for all new entrants. (The allocation scheme could use 02Y, 04Y, 06Y and 08Y first, if this is thought easier to understand.) The carrier selection codes for international calls are the same as those for national calls; the distinction between national and international calls is made by putting 0 or 00 before the NSN, as recommended by ITU-T.

This option adds two digits to call-by-call selections, but the additions are systematic and, in calls through existing operators, the digits are 0. However, it provides dialling parity for many competitors while preserving the essence of the branding by existing operators.

This option permits full parallel running of the old and new codes. Further codes could use 1XY or 03Y (if the default prefix had been 03 replaced by 01).

5. **Existing current national CSCs and new 3-digit national CSCs, with identical international CSCs**. This option leaves 05, 07 and 09 as they are (along with 005, 007 and 009, if desired) and uses 02Y, 04Y, 06Y and 08Y (and eventually 05Y, 07Y and 09Y, with the further possibility of 0XYZ, if required) for all new entrants. The carrier selection codes for international calls are the same as those for national calls; the distinction between national and international calls is made by putting 0 or 00 before the NSN, as recommended by ITU-T.

   This option adds one, two or three (if required) digits to call-by-call selections, but the additions are systematic and, in calls through existing operators, only one is added (an it is 0). Also, it discriminates against new entrants and needs to be accompanied by special obligations on at least the existing long distance operators.

   This option permits full parallel running of the old and new codes. Further codes could use 1XY or 03Y (if the default prefix 03 had been replaced by 01).

6. **Existing current national CSCs and new 2-digit and 3-digit national CSCs, with identical international CSCs**. This option leaves 05, 07 and 09 as they are (along with 005, 007 and 009, if desired), uses 04, 06 and 08 for some new entrants, and uses 02Y, 04Y, 06Y and 08Y (and eventually 05Y, 07Y and 09Y, with the further possibility of 0XYZ, if required) for all other entrants. The carrier selection codes for international calls are the same as those for national calls; the distinction between national and international calls is made by putting 0 or 00 before the NSN, as recommended by ITU-T.

   This option adds one, two or three (if required) digits to call-by-call selections, but the additions are systematic and, in calls through existing operators, only one is added (and it is 0). Also, it discriminates against new entrants and needs to be accompanied by special obligations on at least the existing long distance operators. It would need the use of qualifying requirements or another ‘fair’ mechanism for allocating 04, 06 and 08.

   This option permits full parallel running of the old and new codes. Further codes could use 1XY or 03Y (if the default prefix 03 had been replaced by 01).

6.5 Recommendations for Colombia

We recommend:

1. Investigating the number and size of potential investments in long distance networks.
2. Consulting the industry and consumer groups about making 01 or 03 available for other purposes, dealing with:
   - Whether 01 should be replaced by 03 or 03 should be replaced by 01 after a period of parallel running.
3. Exploring with the industry, including potential new entrants, measures that together would be acceptable to all parties and provide carrier selection codes that would protect the brands of existing operators and be fair to new operators.
4. Letting resellers be accessible by carrier selection.
5. Introducing preselection with attention to the factors that contribute to its effectiveness, in the light of the discussions with the industry.

7 Short codes for directory enquiry services

7.1 Experience in other countries

Information services (originating in enquiries about telephone numbers) are an area for market opening, alongside the telecommunications market itself. There is still an obvious synergy between directory enquiry services and telephony: directory enquiry services use the telephone network (and human operators) and lead to more phone calls. However, there is no longer any necessary connection between them. Telephone companies are by no means the only companies with call centres staffed with trained operators, and voice calls are no longer the only means of providing the requested information: text messages and the internet both offer good alternatives. Improved data storage and communications have also made it much easier to share up-to-date information about telephone numbers.

Factors such as these mean there is no longer any reason to maintain traditional monopolies over information services. This is recognised in Article 14.6 of the Free Trade Agreement, which forbids any unjustified restriction on these services. In the past, directory enquiry services have been provided by access network operators using short codes, but new entrants are now demanding equal treatment. (Some of these new entrants to the directory enquiry service market are not telephone companies.)

There has already been a study in Colombia of international experience in this area[57]. We are in no position to comment on earlier competition and market studies for CRT. However, the international overview is by now slightly dated, so we offer an update for Europe.

7.1.1 UK

The UK liberalisation of directory enquiry services involved extensive research, consultation and consideration of options[58]. It resulted in the old codes 192 (for national directory enquires) and 153 (for international directory enquires) being replaced by 118xxx. (The choice of 118 followed recommendations on harmonising codes in the EU.) The options considered were:

- Retaining 192 and having codes beginning with 118 also: a user would dial 192 for the directory enquiry service provider chosen by the access network operator and dial codes beginning with 118 for other directory enquiry service providers.
- Withdrawing 192 and having codes beginning with 118 instead, with a default code: a user would dial a memorable default code beginning with 118, such as 118811, for the directory enquiry service provider chosen by the access network operator and dial other codes beginning with 118 for other directory enquiry service providers.
- Withdrawing 192 and having codes beginning with 118 instead, without a default code: a user would dial codes beginning with 118 for directory enquiry service providers.

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[57] See *Información de directorio prestada a través de de la numeración 113* (CRT, October 2005) at http://www.crt.gov.co/Documentos/ActividadRegulatoria/ServiciosInformacion/DocAnalisis113_051012.PDF. It covers competitive and market aspects as well as numbering.

[58] For relatively short examples of the discussions see *The Future Use of Legacy Directory Enquiry Numbers* (Oftel, June 2003) at http://www.ofcom.org.uk/static/archive/oftel/publications/consumer/2003/dq0603.pdf, *Allocating access codes for directory enquiry services* (Oftel, March 2002) at http://www.ofcom.org.uk/static/archive/oftel/publications/numbering/2002/dqall0302.pdf and *Access codes for directory enquiry services* (Oftel, September 2001) at http://www.ofcom.org.uk/static/archive/oftel/publications/numbering/denq0901.pdf.

The first and second options were thought to offer insufficient stimulus to competition, so the third option was chosen (though it was admitted to be more difficult for users than the first option in the short term). Some 118xxx codes were reserved to avoid confusion and to allow expansion to 7 digits, and others were allocated in a lottery. In preparation for the change the prices for calls to 192 were gradually raised. After a period of originally 6, but later 9, months for parallel running with 118xxx, starting in December 2002, 192 and 153 were withdrawn.

In the early months of liberalisation, the regulator, Oftel (at that time), received many complaints about the poor quality of the new services. In general the services were little or no cheaper than their predecessors. Test calls to more than 40 providers carried out for the regulator in November 2003 found that 4 out of 10 calls were unsatisfactory (either not being answered promptly or at all, or providing incorrect or inadequate information)[59]. The regulator for premium rate services, ICSTIS, had its mandate extended to directory enquiry services[60].

There has been further market research since then. Most recently, that published in March 2006 showed an improvement in quality, although 192 is still perceived to have been both better and cheaper (and, objectively, average prices confirmed this perception)[61]. Only half of UK adults knew any correct 118xxx code. Two of these codes, 118 118 (a new entrant) and 118 500 (the incumbent), together accounted for 68% of the calls; they were also the most expensive. (Publicity was important: the code 118 707 was also held by the incumbent and was the least expensive but was almost unknown, and the codes 118 811 and 118 888 were known to only 2% of consumers.) Total directory enquiry revenues had fallen from over £200 million in 2002 to £90 million in 2005. This fall was in part a long-term decline attributable to availability of the internet and other information sources, but industry participants in the UK tend to feel that the number change did nothing to help, and probably made matters worse.

Currently there are more than 400 short codes allocated for directory service providers. (Service providers may have more than one code but prefer just to advertise one.)

7.1.2 France

In spite of this experience in the UK, France has recently followed a similar approach, at least from the numbering viewpoint. 118xxx codes were introduced in November 2005, and from April 2006, have replaced the previous very short 12 code and also other short codes used from mobile phones. So far 47 of these new 118xxx codes have been allocated, mainly (as in the UK) with some attractive pattern such as repeated digits.

The market revenues for information services are only published by the regulator, ARCEP, as far as 2004, so they do not yet reflect the change. Over a five-year period, they were showing around 5% a year decline from fixed phones, offset by a gentle growth from mobile phones. The end result was still a decline, though much less steep than that experienced in the UK.

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[59] See *Evaluation of Directory Enquiries Services* (ICSTIS and Oftel, November, 2003) at http://www.ofcom.org.uk/static/archive/oftel/publications/consumer/2003/dqresearch1103.pdf.

[60] ICSTIS is a co-regulatory organisation in which industry and public interest representatives operate within a legal framework to regulate the industry. Oftel had, and now Ofcom has, backup powers that can be used when the powers of ICSTIS are inadequate. There is now a plan for a further extension of the mandate of ICSTIS, to services that were shared cost services but that have become shared revenue services as costs have fallen.

[61] See *Evaluation of Directory Enquiry Services* (ICSTIS and Ofcom. March 2006) at http://www.ofcom.org.uk/research/telecoms/reports/numresearch/dq1105/dq1105.pdf.

7.1.3 EU elsewhere

In their eleventh report on the implementation of the European regulatory framework, EU staff comment[62]:

> In Italy, the removal of [directory enquiry] service from the universal service obligation in September 2003 led to the doubling of prices, while the complete liberalisation of this sector in October 2005 has not yet produced a significant decrease in prices. This has led to questions as to whether the services concerned remain affordable, in line with the requirements of the EU framework.
>
> One of the main points of contention is the high price competing providers are requested to pay in order to obtain the comprehensive database. According to the judgment of the Court of Justice in the KPN case, the costs that an operator can charge for access to the data in the database must be cost-oriented and reflect the cost of making the data available. In Germany, a court has ruled that the incumbent has to pay back a considerable sum of money to one of its competitors who had paid an excessive sum for this data. The Spanish NRA has found a creative solution to the problem: the NRA, as opposed to the designated undertaking, controls the database and gives access to the database for free to any operator seeking it.

7.2 The current position in Colombia

In Colombia the code 113 is used for directory enquiries and NDCs 900 and 901 are used for other information services. Currently 25 operators provide directory information on 113, but many do not offer directory information about all locations and networks in the country.

There are proposals to cater for the short code demand by[63]:

- Retaining the existing code 113 in localities where there is only one local directory enquiry service provider.
- Extending the existing code 113 to 113x for local directory enquiry services in localities where there is more than one local directory enquiry service provider.
- Introducing the new codes 130x for national directory enquiry services.

The proposals indicate that CRT will allocate codes wanted by directory enquiry service providers according to whether applicants already provide the service, how many customers they have, and when they applied. They also indicate that national directory enquiry services must provide information about at least the seven main cities in Colombia and will have short codes that route directory enquiries to them from throughout Colombia.

The proposals do not consider international directory enquiry services. They do mention 120x as a possible alternative to 130x; it could perhaps be used for international directory enquiry services. However, as international directory enquiry services are generally more costly to operate and less frequently used than national directory enquiry services, premium rate numbers could be more appropriate to them than short codes.

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[62] See *Volume I of the Annex to the European Electronic Communications Regulation and Markets 2005 (11th Report)* (Commission of the European Communities, February 2006) at http://europa.eu.int/information_society/policy/ecomm/doc/implementation_enforcement/annualreports/11threport/sec_2006_193-vol1.pdf.

[63] See *Borrador Resolución 113* (CRT, October 2005) at http://www.crt.gov.co/Documentos/ActividadRegulatoria/ServiciosInformacion/ProyectoResolucion_051012.pdf.

7.3 Options in Colombia

The evidence in Section 7.1 suggests that making directory enquiry services competitive does not necessarily benefit users, at least in the short term. However, our concern here is not with competition policy but with numbering.

The experience of other countries also suggests that, if directory enquiry services are made competitive then there may be many service providers and that memorable or convenient short codes give a competitive advantage. With the current proposals, the service provider obtaining the code 1133 may attract disproportionately many users. Thus even if there are not more than 10 applicants to provide the service, the current proposals may give an advantage to certain applicants and may not maximise the benefit to users. Of course other 113x codes may appeal to some people for personal or cultural reasons, and 5, 7 and 9 are already associated with brands; whether these effects would be enough to outweigh the advantage of 1133 could be a subject for consumer research. If the advantage is regarded as significant, it should be reduced. This could be done either by withholding codes such as 1133 (to avoid distortion and to allow expansion) or by having longer codes: with 5-digit codes at least the holders of 11311, 11313, 11331 and 11333 would need to compete with each other (though 11333 would probably still have an advantage, and callers might find themselves speaking to unexpected directory enquiry service providers, after dialling the digits wrongly)[64].

In addition, directory enquiry service providers who wish to promote their short codes as brands throughout Colombia would want the same short codes throughout the country. The number of allocated short codes might then greatly exceed the number of directory enquiry service providers available in a given locality; 5-digit or 6-digit codes would be needed, especially (but not exclusively) for codes beginning with 130.

With the currently proposed distinction in numbering between local directory enquiry services and national directory enquiry services there is little incentive for a local directory enquiry service provider to develop the service by offering directory information about all locations and networks in the country. The distinction may reflect the low numbers of long distance calls in Colombia; however, it may also re-inforce the obstacles to raising that number. Though we appreciate that currently local directory enquiry services may be cheaper and easier to provide than national ones, we wonder whether a time limit should be placed beyond which directory enquiry services would need to offer national information. (This time limit would be set after discussing with the current service providers the state of development of their database systems.) In that case, with the current proposals, when directory enquiry service providers would apply to be allocated two codes, one beginning with 113 and one beginning with 130; they could then move their services to whichever code suited them best by the time limit.

Making directory enquiry services competitive can introduce further complications. For Colombia, one to note is that a directory enquiry service that offered the option of call completion (so the user would not need to remember and dial the number) might do so with or without taking into account the carrier selection preferences of the user.

Thus there are various possible ways in which the proposed used of codes beginning with 113 can be varied. However, there is also a more fundamental choice, between extending 113 and not extending 113. Figure 10 summarises this choice.

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[64] For codes of the forms 113x, 113xx and 113xxx there are respectively 2, 4 and 8 codes that use only the digits 1 and 3. For codes of the form 113xx there are 8 more codes that have 2 repeated digits other than 1 and 3. For codes of the form 113xxx there are 24 more codes that have 3 repeated digits other than 1 and 3 or that have 3 as the fourth or sixth digit along with 2 repeated digits other than 1 and 3. Similar remarks apply to 130x, 130xx and 130xxx.

We believe that option 2 in Figure 10 deserves consideration alongside option 1: it would be more convenient for users, especially in the larger cities, and could promote competition and the development of national directory enquiry service providers at least as effectively.

Option	Directory enquiry service short codes	Examples of digits dialled in complete numbers	Transition	Fairness to new service providers	Periodic franchise change	Number of service providers supported
1: Existing or extended current directory enquiry short codes using 113 and new directory enquiry short codes using 130	Local or national: 113 or 113X or 113XY or 113XYZ National: 130X or 130XY or 130XYZ	Local or national: 11375 National: 13075	Poor	Good	Irrelevant	20 or 200 or 2000
2: Existing current directory enquiry short codes using 113 and new directory enquiry short codes using 130	Local or national: 113 Local or national: 130X or 130XY or 130XYZ	Local or national: 113 Local or national: 13075	Good	Good	Necessary	10 or 100 or 1000

Figure 10 Comparison of directory enquiry service code options

In more detail the options in Figure 10 are as follows:

1. **Existing or extended current directory enquiry short codes using 113 and new directory enquiry short codes using 130**. This option keeps 113 (where there is only one local directory enquiry service provider), extends 113 to longer codes beginning with 113 for local directory enquiry service providers (where there is more than one local directory enquiry service provider), and uses codes beginning with 130 for national directory enquiry service providers. If there were a time limit by which local directory enquiry services would need to become national directory enquiry services, service providers might hold two codes, one beginning with 113 and one beginning with 130, so that they could then move their services to their favoured code by the time limit.

   This option adds digits to all calls to directory enquiry services (except in localities where there is only one local directory enquiry service provider). However, it provides dialling parity for many competitors. It does not do this in localities where there is only one local directory enquiry service provider and another service provider subsequently wishes to become a local directory enquiry service provider: unless the directory service codes undergo a further change, with 113 being replaced by 113x. Parallel running of the old and new codes is not feasible: attempts to dial 113 after the change would be met by a free recorded announcement (after a timeout).

2. **Existing current directory enquiry short codes using 113 and new directory enquiry short codes using 130**. This option keeps 113 and uses codes beginning with 130 for all local directory enquiry service providers and national directory enquiry service providers.

   This option does not disturb current dialling habits. However, it could discriminate against new entrants. To make it acceptably fair, an important difference between it and similar options for carrier selection codes can be exploited: the long distance operators have invested in marketing their codes, whilst the current holders of 113 have not needed to do so. The holders of 113 can therefore be changed.

   One way of making this change possible this would be to arrange that 113 was held on a franchise in each locality, renewable at intervals of, say, 3 years by a directory enquiry service provider that also held a code starting with 130. Each access network operator

would be obliged to provide access using 113 to the holder of the franchise, as well as to all directory enquiry service providers using codes starting with 130. The franchise might be awarded on the basis of a beauty contest, an auction or a lottery. As this franchise would be particularly important to users, in this case we favour having a beauty contest, in which the objectives might be to minimise the tariffs and maximise the coverage (so preference would be given to applicants offering directory information about all locations and networks in the country, at least after a period for developing their database systems). An auction could be especially badly suited to this case, because it might be distorted by certain forms of participation[65].

Another way of making this change possible would be to impose requirements that directory enquiry service providers would need to satisfy to become qualified to be accessible using 113; these qualifying requirements might be upper bounds on tariffs and lower bounds on coverage. Each access network operator would be obliged to provide access using 113 to a directory enquiry service provider that satisfied the requirements, as well as to all directory enquiry service providers using codes starting with 130. However different access network operators in the same locality could provide access using 113 to different directory enquiry service providers. (An exception to this principle might be needed if an access network operator has a financial interest in a directory enquiry service provider.)

7.4 Recommendations for Colombia

We recommend:

1. Consulting the industry and consumer groups about an alternative to the currently proposed change in meaning of 113 and 130, dealing with:
   - Whether directory enquiry service providers should need to satisfy qualifying requirements if they wish to hold 113.
   - Whether both local directory enquiry services and national directory enquiry services should use 130.
   - Whether there should be a limit on the period during which a directory enquiry service provider need not offer national information.
2. Making available codes for 100 or 1000 possible directory services (some of which would be reserved or withheld), with the choice between them to be made when the applications for codes have been submitted and demand can be estimated well.
3. Reviewing the consumer protection arrangements for directory enquiry services, in the light of the similarity of these services to other value added services.

[65] For example, an access network operator that has a financial interest in a directory service provider might make high bids in an auction for the right to hold 113 if there are shared revenue arrangements, because it will benefit from high prices for calls to 113 no matter who wins the auction.

8 Short codes due to mobile phones

8.1 General aspects

Mobile phones introduce new forms of numbering because of:

- Short Messaging Service.
- Multimedia Messaging Service.
- Unstructured Supplementary Service Data.

Here we look at them in turn, bearing in mind that the first is currently the most important but that they all raise similar questions.

8.1.1 Short Messaging Service

Along with GSM mobile phones, the Short Messaging Service (SMS) is experiencing tremendous growth around the world. The numbering plan for SMS is technically separate from that for telephony. However, for messages to subscribers it uses E.164 numbers that by convention are normally the same as the E.164 numbers for voice calls to the same mobile phones[66]. Some service providers use this convention, with conversions between text and speech, to make SMS messages reach fixed phones.

Commercial and non-commercial SMS messages are now widely offered in value added services. These services might be accessed by dialling E.164 numbers, but they might also be accessed by dialling short codes (typically of 5 digits) that regulators have played no part in allocating[67]. If regulators try to intervene, service providers may point to the difference between E.164 numbers and short codes. However, co-ordination between SMS numbering and telephony numbering could be beneficial, because:

- Callers may well be confused if they get unrelated results when sending SMS messages and making voice calls to the same short codes (especially as there is the convention that E.164 numbers for SMS messages to subscribers are those for voice calls to subscribers).
- Service providers might wish to provide voice and text information on the same number (so, for example, the code 23456 might give weather information in both telephony IVR voice calls and SMS messages).

The value added services are often provided on short codes that would clash with subscriber numbers and that are therefore not usable on fixed phones in open numbering plans. However, this has not caused problems in the past, because text cannot usually be sent from or received by fixed phones.

In fact a mobile access network operator might wish to deliberately adopt short codes that were not usable on fixed phones in order to discourage access to the value added services from other networks. (The value added service provider is not necessarily the network operator or even a direct customer of the network operator.) Certainly some service providers have been reluctant to achieve interconnection between different mobile access networks for SMS messages using short codes.

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[66] For several years the first implementation of mobile number portability, in Singapore, provided portability for voice calls but not for text messages. It presumably violated this convention about SMS numbering and E.164 numbering.

[67] In this report ‘dial’ does not indicate the use of voice calls instead of text messages, far less the use of telephones with physical dials. Instead it refers to any way of using a telephone to signal digits to the network (now, usually, by pressing keys on a keypad).

8.1.2 Multimedia Messaging Service

The Multimedia Messaging Service (MMS) can use email addresses or E.164 numbers to deliver messages to subscribers (again with the convention that messages to subscribers use copies of the relevant E.164 numbers). A standard due to the European Telecommunications Standards Institute (ETSI) provides for the delivery of MMS messages through fixed access networks, based on a similar standard for the delivery of SMS messages through fixed access networks.

As with SMS, MMS messages may be offered in value added services that are accessed by dialling short codes.

8.1.3 Unstructured Supplementary Service Data

Unstructured Supplementary Service Data (USSD) uses short codes of the form 1XY (preceded and followed by occurrences of * or #). According to rules laid down by ETSI these short codes are intended to be interpreted by the home network if X is 0, 1, 2, 3 or 4 and by the visited network if X is 5, 6, 7, 8 or 9; the ETSI specifications do not standardise the interpretations. (There are other codes used by mobile phones that are fully standardised.)

Codes might need to be chosen carefully and harmonised between networks: it is said that in one country a child helpline service, on telephony short code 147, was mistaken for a service on USSD short code 147. There is particular scope for confusion if short codes for other purposes (such as SMS and MMS) contain * or #.

8.2 Experience in other countries

In some countries, mobile operators are joining forces to manage SMS short codes so that value added service providers can get a single number that will work in all mobile networks. This is so in the UK, France and South Africa, for example. However, there are other models, with more direct involvement by the regulator (as in Ireland and Finland, for example).

There are also countries such as Austria where SMS short codes are deliberately confined to single networks; value added services have to use E.164 numbers and directory enquiry have to use short codes that are subject to tariff limitations like those for premium rate telephony services.

8.2.1 UK

In the UK the Short Code Management Group, run by the mobile access network operators, manages the distribution of SMS short codes[68].

In its code of practice it splits the SMS short code range into subranges for different content, including pay-for-product (purchasing something that is paid for on the phone bill); only one subrange has an effective tariff limitation (based on that for premium rate telephony services). Content is classified by the Independent Mobile Classification Body (IMCB), a subsidiary of the Independent Committee for the supervision of Standards of Telephone Information Services (ICSTIS), which regulates premium rate telephony and SMS services[69]. (This is one example of a fairly common occurrence in the UK, the proliferation of organisations with the intention of increasing self-regulation but the likelihood of confusing customers.)

[68] See http://www.short-codes.com.

[69] See http://www.imcb.org.uk and http://www.icstis.org.uk.

8.2.2 Ireland

The mobile access network operators asked the regulator, ODTR (at that time), to introduce a systematic treatment of short codes for SMS in 2001. After putting forward proposals for consultation ODTR decided that[70]:

- The existing systems, in which service providers used short codes in their own ways, was unsatisfactory. It did not permit the introduction of value added services from third parties, interconnection between networks, or tariffs at anything other than the standard levels for SMS messages.
- There should be 5-digit short codes in the range 5xxxx for SMS short codes from mobile phones. (The numbering from fixed phones would be considered later, if necessary.)
- Over half the range would be reserved for expansion, until the number of codes needed became clearer. (Some respondents thought that one code per tariff point per service provider would be enough, as key words in the messages could be used to distinguish between services; others disagreed, as they wanted numerical branding.)
- The short code range would be split into subranges with different tariffs. For the allocated codes the charges per message, on top of the ordinary SMS charge, would be:
  - €0.00 for 50xxx.
  - €0.16 for 51xxx.
  - €0.80 for 53xxx.
  - Unlimited for 57xxx and 59xxx (which would be for “adult” services).
- Codes would be allocated by the regulator (not the mobile access network operators) to value added service providers, initially in a lottery and subsequently in response to requests.
- Content and consumer protection aspects would be looked after by RegTel, which also supervised premium rate telephony services.

8.2.3 France

In France SMS+, run by the mobile access network operators, manages the distribution of SMS short codes[71]. It ensures that:

- Mobile access network operators may charge value added service providers different amounts for short codes that are memorable to different extents, by using distinctions between[72]:
  - ‘Gold’ codes (33 of them for each first digit) ending in four repeated digits, four consecutive digits or three occurrences of 0, such as 61111, 61234 or 61000.
  - ‘Silver’ codes (317 of them for each first digit) ending in three repeated digits, three consecutive digits or two occurrences of 0, such as 61222, 61345 or 61200.

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[70] See *A Framework for Value-added Text Messaging (SMS) Services* (ComReg, January 2002) at http://www.comreg.ie/_fileupload/publications/odtr0214.pdf.

[71] See http://www.smsplus.org.

[72] SMS+ provides examples of gold, silver and bronze numbers, not precise formation rules or counts.

- ‘Bronze’ codes (783 of them for each first digit) having two sets of two repeated digits, two sets of two consecutive digits or two sets of one occurrence of 0, such as 61122, 61245 or 61020.
- ‘Nickel’ codes (8867 of them for each first digit) lacking distinctive features.

- The short code range is split into subranges with different tariffs, with charges per message (as well as the ordinary SMS charge) of:
  - €0.00 for 3xxxx.
  - €0.05 for 4xxxx.
  - €0.20 for 5xxxx.
  - €0.35 for 6xxxx.
  - €0.50 for 7xxxx.
  - €1.00 or €01.50 for 8xxxx (with a maximum charge per service invocation of €3.00).

SMS+ has codes of practice for value added service providers that consider content and consumer protection.

8.2.4 EU elsewhere

Concerns have been growing in the EU about promoting competition and protecting consumers if short codes are officially unregulated. (Forms of self-regulation and co-regulation are potentially acceptable.) The regulators have recently been urged to take final responsibility for SMS numbering, with delegation to other organisations where appropriate, and to protect consumers in various ways (such as barring messages, introducing messages about tariffs, and assigning tariff or content information to numbering subranges).

8.2.5 South Africa

Another organisation that manages the distribution of short codes and deals with consumer protection aspects is the South African Wireless Application Service Providers’ Association, run by the value added service providers in South Africa[73]. Its websites include reports of some hundreds of complaints lodged by competitors and members of the public since the code of practice was launched in 2004. (Among these hundreds of complaints, however, only tens are regarded as valid.)

8.3 Options in Colombia

The management of SMS short codes could be left entirely to the mobile access network operators, with no intervention by CRT. However, doing this could lead to some of the following problems:

- **Discrimination in network access against third party value added service providers**. Mobile access network operators might regard all the short codes as being specific to their networks. Though they might permit access to third party value added service providers they might keep the most memorable numbers for themselves.
- **No harmonisation between networks**. Customers would need to use different short codes on different networks for the same value added services. Value added service providers would be unable to brand their services simply or to port numbers between networks (because of possible conflicts).

[73] See http://www.waspa.org.za and http://www.smscode.co.za.

- **Inadequate protection for consumers**. The tariff and content might not be indicated by the numbering or controlled in any other way.

The following points are also relevant, though we do not regard them as very important in Colombia:

- **Difficulties in gaining access to value added services from fixed phones.** Fixed phones would not have the same short codes, but they could use suitable non-geographic E.164 numbers or longer short codes.
- **Complications in closing the numbering plan**. Closing the numbering plan in Colombia would greatly lengthen dialling sequences for local calls, so we do not recommend it anyway.
- **No interoperation between networks**. Value added service providers would be obliged to connect explicitly to multiple networks. However, there have been limitations in the ETSI standards for interoperation with SMS short codes.

Schemes for harmonising short codes could extend to automatic transformations between formats, as for 1XY codes. Thus SMS and MMS short codes without * and # could be transformed automatically into:

- Longer short codes having the same tariffs and suited for fixed phones (with, say, 8WXYZ and 9WXYZ being transformed into 138WXYZ and 139WXYZ respectively, in which there is a reminder of the mobile NDCs).
- Non-geographic E.164 numbers having the same tariffs (with, say, 8WXYZ and 9WXYZ being transformed into 800 138 WXYZ and 900 139 WXYZ respectively).

Of course transformations of short codes into 800 008 WXYZ and 900 009 WXYZ, for example, might appear more obvious, but they would not be consistent with the suggested transformations of short codes for fixed phones to non-geographic numbers. Incidentally, these transformations point to two further rules for SMS and MMS short codes without * and #:

- They should start with digits that are used for NDCs in the same ways.
- They should have at most 5 digits (as otherwise they cannot be transformed into 7-digit short codes for fixed phones).

8.4 Recommendations for Colombia

There is as yet no common approach to short codes for SMS, MMS and USSD in Colombia. We recommend:

1. Consulting the industry and consumer groups about the SMS and MMS short code space structure, dealing with, in particular:
    - Which short codes should be in a set of common service codes for parallel use by all fixed and mobile access network operators.
    - What other harmonisation between short codes on fixed and mobile phones (including those using * and #) would be feasible.
    - Whether an automatic transformation of short codes into non-geographic E.164 numbers would be useful.
    - Whether delegated management of short codes, within the overall national numbering plan, would be desirable.

2. Reviewing the consumer protection arrangements for value added services, bearing in mind the possibilities for barring messages, introducing messages about tariffs, and assigning tariff or content information to numbering subranges.
3. Monitoring the development of USSD short codes to determine whether they should be subject to the same regulation as SMS and MMS short codes.

9 Number portability

9.1 General aspects

9.1.1 Forms of number portability

Number portability can take three forms:

- **Location number portability**. This involves keeping the same phone number when changing from one location to another. As networks move towards being based on IP, the routing spaces will become flatter so numbers will become portable over larger areas and will lose much of their geographic significance. Location number portability should ultimately be very easy.
- **Service number portability**. This involves keeping the same phone number when changing from one service to another (from analogue to digital mobile telephony, for example). Numbers can be portable between services if numbering does not differentiate between the services. The inherent flexibility of IP applications makes the differences between services very difficult to define: to one customer an application may offer only voice whilst to another customer it offers text and video as well. (A similar example occurs in Section 3.3, where we mention “find me / follow me” services.) Even without IP there can be problems, when customers change their services between fixed access, converged fixed-mobile access, and mobile access. Service number portability is therefore assisted by not using numbering to differentiate between services.
- **Service provider number portability**. This involves keeping the same phone number when changing from one service provider (the ‘donor’) to another (the ‘recipient’). Customers may change their service providers in order to improve their services, so service provider number portability, like service number portability, is assisted in some ways by not using numbering to differentiate between services. Customers may also change their service providers in order to reduce their bills, so service provider number portability is assisted by not tying numbering to price floors (as opposed to price ceilings). Service provider number portability is the form of number portability that creates most interest, because of its potential for stimulating competition.

Though service provider number portability is assisted in some ways by not using numbering to differentiate between services, it might also be made more difficult, because services with very different implementations might occupy the same numbering range: in principle one numbering range might be used by VOIP networks, traditional fixed access networks and traditional mobile fixed access networks. Interworking of signalling and voice channels between these different networks is a consequence of satisfactory interconnection; it is not affected by the need to achieve service provider number portability. Interworking in the presence of number portability is made more difficult only by the need to ensure compatibility between the implementations of service provider number portability in the different networks.

9.1.2 Implementations of number portability

There are two classes of implementation of service provider number portability:

- **Two-network implementations**. These do not involve the donor networks in the treatment of calls to ported numbers: the originating networks pass calls direct to the recipient networks without interrogating the donor networks. The main version is generally called All Call Query or Query By Default; optimised versions of it have other names, such as Location Routing Number or Query On Digit Analysis.

- **Three-network implementations**. These involve the donor networks in the treatment of calls to ported numbers: the originating networks either pass calls to the donor networks, which then pass them to the recipient networks, or interrogate the donor networks about whether the numbers have been ported (and in one form, about which are the recipient networks) and then pass them to the recipient networks. The versions are generally called Onward Routing or Facility Redirect (which can be seen as a an evolution from call forwarding implementations), Query On Release and Call Dropback or Return To Pivot.

Three-network implementations are usually cheaper when there are small proportions of calls to ported numbers. In the UK a three-network implementation was chosen many years ago on grounds of cost and expediency; two major fixed access network operators now believe that moving to a two-network implementation only pays off if at least 20%-30% of calls go to ported numbers, and a recent review for Ofcom concluded that an ENUM system with service provider number portability might be introduced before there was any other reason to change to a three-network implementation[74]. Even the cheaper implementations have costs[75].

In some cases implementations of service provider number portability can work together, but this may be less likely to be so for mobile access networks than for fixed access networks. Both fixed access networks and mobile access networks can use two-network and three-network implementations, but the details of how they do so differ. In particular, mobile access network implementations often use Signalling Relay Functions and Home Location Registers that are not available in fixed networks[76]. However, we can say very broadly that:

- An originating network can use a two-network implementation of service provider number portability even if the donor network would be unable to use a two-network implementation.
- An originating network may be able to use a three-network implementation of service provider number portability even if the donor network would be unable to use a three-network implementation; however, the states on the originating network may need to be scrutinised to confirm that this is so (at least for Query On Release and Call Dropback).

Thus different access networks may be able to use different two-network and three-network implementations. However, if implementations use centralised databases (as they often do for All Call Query), there can be economies of scale in ensuring that the databases are shared between operators and therefore that the implementations are the same for different operators.

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[74] See *Costs and Implementation Issues of a Central Database Solution for Number Portability in the UK* (Mason, April 2004) at http://www.ofcom.org.uk/consult/condocs/uk_numb_port/uk_numb_port_cons/mason/mason_report.pdf.

[75] In Australia a smaller operator uses All Call Query (at an estimated cost of AU$100 millions) and a larger one uses Onward Routing (at an estimated cost of AU$70 millions). See *Telecommunications Competition Regulation* (Australian Government Productivity Commission, December 2001) at http://www.pc.gov.au/inquiry/telecommunications/finalreport/telecommunications2.pdf.

[76] For a description of the mobile access network functions in service provider number portability see *3rd Generation Partnership Project; Technical Specification Group Core Network; Support of Mobile Number Portability (MNP); Technical realization; Stage 2 (Release 6)* 3GPP TS 23.066 (3GPP, December 2004) at http://pda.etsi.org/pda/home.asp?wkr=RTS/TSGN-0423066v600. An alternative to these functions that uses IN for both fixed access networks and mobile access networks is put forward in ITU-T Q.Supplements 3, 4 and 5 at http://www.itu.int/rec/T-REC-Q.Sup3, http://www.itu.int/rec/T-REC-Q.Sup4 and http://www.itu.int/rec/T-REC-Q.Sup5, but it does not deal with non-call-related signalling, like that used for SMS and MMS. As mobile networks depend on Home Location Registers even when they do not have service provider number portability they are sometimes able to provide service provider number portability without significant upgrades.

Service provider number portability can be implemented for VOIP in various ways related to those adopted in traditional fixed access networks. It may also be implemented by using an ENUM system; doing this essentially amounts to using a two-network implementation in the terminology of Section 9.1.1. Which ways are more easily implemented may depend on the VOIP equipment: VOIP equipment provided by a traditional telephony network equipment supplier might support traditional implementations of service provider number portability but have numbering translation and routing mechanisms that conflicted with ENUM, whilst VOIP equipment provided by a new “soft switch” supplier might not support traditional implementations of service provider number portability but have interfaces for ENUM.

Service provider number portability should carry reciprocal obligations: a recipient network should also be able to act as a donor network. There is no requirement in principle for all the numbers sharing the same NDC to be portable, even if some of them are portable. (In particular, different services can occupy different numbering subranges in the same NDC.) However, in practice the network implementations might be more efficient, and the customer explanations would be less complicated, if this were so.

9.1.3 Portability of other identifications

VOIP can also use other forms of identification besides E.164 numbering, particularly SIP URIs (such as sip:person@one-isp.net.co). Often these URIs are provided to customers by service providers and incorporate the domain names of the service providers. Nonetheless they can be made portable through the use of SIP redirect servers (for example, transforming sip:person@one-isp.net.co into sip:person@another-isp.net.co). Similar network elements can provide portability for other applications, such as email and website access.

In addition the dependence on proprietary domain names could be weakened by introducing a personal domain naming system (for example, providing sip:casa@person.yo.co). The system in the Netherlands deserves consideration, as it includes a number with the name to ensure that two people having the same name can both have personal domain names.

VOIP might even use Skype URIs. (such as callto://person). Unlike other VOIP systems Skype uses its own protocol, which is not openly available, and its own URI scheme, which are not registered with the Internet Assigned Numbers Authority (IANA).

Regulators may well have the power to impose number portability, because phone numbers form a centrally administered scarce resource. However, they are unlikely to have the power to impose portability for other forms of identification (and an ENUM system does not help to provide it). They can at best propose it.

9.2 Experience in other countries

Service provider number portability is often regarded as a good way of stimulating competition. There are indeed some countries where it seems to have had this effect. Thus after the introduction of service provider number portability for mobile numbers:

- In Hong Kong in three years mobile phone penetration rose from 45% to 99%, prices fell by 60% and the monthly churn rose from 3% to 5% (but then fell back).
- In Finland in one year market shares for the smallest service providers together rose from 1% to 12% and the monthly churn rose from 1% to 2%.

The cases of Hong Kong and Finland are the ones that are usually cited. Unfortunately, there are also countries where the introduction of number portability has not had the strong effects that were predicted. This is so, for example, in Singapore, Taiwan and Australia, where surveys before the introduction of service provider number portability suggested that very high proportions of customers might change their service providers if they could keep their numbers.

In the EU, service provider number portability is mandatory for geographic, mobile and specially tariffed numbers. Yet except in the Czech Republic (for geographic numbers) and Finland (for mobile numbers), fewer than 1% of customers port geographic or mobile numbers every year[77]. There have been price reductions but they have not been clearly brought about by service provider number portability.

Not only may the benefits of service provider number portability be smaller than predicted: the costs and timescales may be larger. (For example, in Ireland the implementation costs are thought to have been four times the original estimates of 2000 and the capability did not become available to the public until 2003; however, in that particular case some of the original estimates were derived merely by scaling estimates from the UK.)

Portability for forms of identification other than numbering, as discussed in Section 9.1.3, has not yet been implemented in a regulated manner, so its effectiveness cannot be assessed at all.

9.3 Options in Colombia

Service provider number portability can be expensive to implement and be ineffective in increasing competition greatly. We can identify factors that appear to contribute to its effectiveness (such as having well publicised, quick, free and simple porting processes and preventing customers from being locked to service providers by long contracts or subsidised telephones). However, we do not know a way of guaranteeing its effectiveness[78]. In addition:

- If there is a large unserved market, service provider number portability might encourage new entrants to compete for the existing (relatively high value) customers of the incumbent, not to provide services to unserved customers.
- If there is a shortage of skilled staff, people might be better employed on other things (such as improving quality of service).
- If there is very variable coverage, quality may be more important than price to customers.
- If there are announcements about changed numbers, porting the numbers may be unnecessary, except perhaps where a business depends critically on its phone numbers.

We say nothing more about this here, as we are dealing mainly with numbering, not with competition policy. We note only that the moment for introducing service provider number portability must be chosen with care. In particular, its network implementations, like the network implementations of carrier preselection, must be accompanied by customer service systems with suitable staff attitudes and procedures.

In Section 3.3 we emphasise the role of numbering in contributing to tariff transparency. Unfortunately service provider number portability can reduce tariff transparency, because calls that are actually off-net calls may be thought by the callers to be on-net calls. Tariff transparency in the presence of number portability can be improved by:

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[77] See *Volume II of the Annex to the European Electronic Communications Regulation and Markets 2004 (10th Report)* (Commission of the European Communities, December 2004) at http://europa.eu.int/information_society/policy/ecomm/doc/implementation_enforcement/annualreports/10threport/sec20041535vol2en.pdf. The figures are incomplete, partly because at that time service provider number portability had not yet been introduced in some countries.

[78] According to our figures, there is service provider number portability for geographic numbers in at least 36 countries, for mobile numbers in at least 36 countries and for specially tariffed numbers in at least 27 countries. There should therefore be plenty of evidence to consider, but of course there are large variations between countries, even in the EU, which has at least a shared regulatory framework.

- Making available free information before calls to ported numbers (and typically letting callers to opt in or out of getting the information), through making announcements (as in Portugal) or sending tones (as in Lithuania).
- Making available free information about ported numbers all the time, in freephone voice calls (as in Finland), in freephone text messages (as in Germany), in bills (as in Austria) or on websites (as in Denmark).
- Requiring that the call charges are independent of whether called numbers have been ported (as in France, for both fixed access networks and mobile access networks).
- Requiring that that the receiving party pays for all portions of calls coming from off-net.

Thus announcements (about changed numbers or changed charges) could be important whether or not service provider number portability is introduced.

9.4 Recommendations for Colombia

Number portability is a network feature that influences the implementation of numbering but that has little influence on the planning of numbering plan. It is largely outside the scope of this study. However, there are some ways in which it is related to the numbering plan. We recommend:

1. Checking that any network implementations of service provider number portability that are adopted interwork economically for services that can occupy the same numbering range.
2. Attending to all the other factors that contribute to the effectiveness of service provider number portability when introducing it.
3. Encouraging the adoption of portability for identifications other than phone numbers.
4. Introducing, in consultation with service providers, suitable processes to help the migration of users between service providers, with the correct and speedy transfer of information for service provider number portability.

10 ENUM

10.1 General aspects

10.1.1 Uses of ENUM

Extending the national numbering plan to VOIP lets calls be set up between IP terminals and traditional phones. However, it is unsatisfactory on its own, if calls using phone numbers are to be set up from one IP network to another IP network. It can lead to indirect routes, with calls leaving the calling party network through gateways into an intermediate traditional network, traversing that network, and entering the called party network through other gateways. The intermediate traditional network would offer more routing information; however, it would also convert between voice over IP and its own representation, thereby increasing call costs and decreasing call quality.

To make routes direct for calls using phone numbers, an IP network needs to find routes towards other IP networks by inspecting the phone numbers. In fact a network may find several IP communication services (such as email, fax and voice mail), with different routes, for each phone number. Some routes may use direct IP connections and other routes may pass through gateways into traditional networks.

The tElephone NUmber Mapping (ENUM) defines a transformation of phone numbers into domain names that can then be looked up using the Domain Name System (DNS); for example, the phone number +57 1 964 0235 is transformed into 5.3.2.0.4.6.9.1.7.5.e164.arpa. When DNS is looked up it lists identifications of services used by the "owner" of the phone number, along with the communication preferences of the "owner"; for example, the list might contain sip:person@one-isp.net.co and mailto:person@one-isp.net.co, with preferences indicating that the person would prefer to be contacted using SIP but, failing that, could be contacted using email.

The most important distinction between enum systems concerns whether service providers or users can supply information to, and get information from, these sources. The corresponding enum systems are:

- **Carrier enum** (which for ENUM is also known as 'infrastructure ENUM'). Service providers supply information about the phone numbers and preferred communication services of their customers, and other service providers can get that information. The preferences in this case are likely to be those of the service providers; in fact service providers may not have, or may not wish to supply, information about all the communication services preferred by their users[79].
- **User enum** (which for ENUM is also known as 'public ENUM'). Users supply information about their phone numbers and preferred communication services, and other users can get that information. The preferences in this case are those of the users and can include all of the communication services that the users take.

[79] For example, if a user has a phone number and a URI sip:person@one-isp.net.co provided by one service provider, that service provider may be unwilling to update the information when the user replaces the URI with, say, sip:person@another-isp.net.co from a different service provider.

10.1.2 Developments from ENUM

There are other systems for finding IP addresses from phone numbers. Some use DNS in the same way as ENUM but do not use the e164.arpa domain. Others do not use DNS but instead have entirely different implementation techniques[80].

When an IP network finds other communication services from phone numbers, the phone numbers are just treated as familiar unambiguous names; other naming systems could be devised and used instead. (For this reason ENUM itself has no implications for the structure of numbering.) VOIP service providers could choose to by-pass the national number allocation arrangements by adopting their own numbers looking like phone numbers. These numbers would provide VOIP but would not give access to traditional networks; they could even cause number changes when they are finally found to conflict with the national numbering plan[81]. To ensure that only valid numbers are used, there needs to be agreements between the service providers and any central authority. For ENUM this central authority is provided at the global level by ITU-T and at the national level by a neutral organisation working with the regulator and the registries controlling the DNS servers.

There needs to be one authoritative primary source of the ENUM information; secondary sources may then extract this information for consultation by service providers or users. (A similar primary source of information is needed also for directory enquiries and service provider number portability.)

ENUM and DNS provide a specific instance of identity management, in which the rights to use certain systems or get certain information are associated with potential users. These rights might have nothing to do with communication services, and in fact enthusiasts have suggested that the phone numbers of individuals might serve as the naming system for identity management in several areas.

10.2 Experience in other countries

In various countries ENUM systems are now planned for deployment. Some are carrier ENUM systems (in Poland and Romania) and some are user ENUM systems (in Austria, Germany and Ireland)[82]. In other countries the trials have been concluded and the governments are now considering whether the benefits of deployment would justify active support and planning.

Thus ENUM systems (and indeed enum systems) have not been adopted rapidly. In particular, user enum systems appear to suffer because the commercial drivers for them are weak. More generally, carrier enum systems have fewer disadvantages than user enum systems, so they are favoured in principle more often than user enum systems[83].

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[80] In this report the term ‘enum’ refers to any system that is similar to ENUM just by being intended for finding IP communication services from phone numbers; this usage is not standard. The term ‘ENUM’ should really be used only for such a system that has a centralised implementation using a particular mapping of phone numbers to domain names in the e164.arpa domain.

[81] Some voice over IP service providers in the US may be risking doing this, by giving users numbers that are too long to conform with E.164 but that start with NPA codes not allocated in the NANP.

[82] For a report on the status of ENUM deployment in many countries, maintained by Réseaux IP Européens (RIPE), which provides co-ordination support for ENUM delegations, see http://enumdata.org. The report may not be not fully up to date; that in itself could indicate something about the general level of enthusiasm for ENUM.

[83] There may be plans for deploying carrier ENUM systems that are not widely known, because unlike user ENUM systems they do not use the e164.arpa domain and do not need to be recorded with RIPE.

10.3 Options in Colombia

The arguments for having an enum system include:

- It lets service providers have direct routes for VOIP calls using phone numbers. It therefore helps with the growth of competition between VOIP and traditional telephony.
- It can be used by communication services other than VOIP. For example, MMS was intended to use ENUM (though in fact it is generally implemented without ENUM, partly to avoid any regulatory problems when ENUM information is shared internationally between service providers).
- It can be used in implementations of traditional network features like number portability and specially tariffed numbering, because it has a centralised implementation, just as has Intelligent Networking (IN).
- In the form of user enum, it could provide something having similar effects to portability of domain names (for email addresses, for example); users would tell people their phone numbers, not the URIs of their communication services[84].
- In the form of user enum, it could let users make personal information available globally for new internet applications just by using phone numbers as a naming system.

There have been trials of ENUM systems in several countries. Often these have been led by enthusiasts for ENUM, but sponsored by the government. (The trials in Austria are particularly well publicised, but there have been others in Ireland, Sweden, the UK and elsewhere.) These trials have shown that public ENUM presents various problems. Many of these would exist for user enum in general, but not for carrier enum. The main problems are:

- User enum lets people read user information about others. It thereby makes “spamming” (communicating with someone else without any implied consent, particularly through email) and “spoofing” (pretending to be someone else) easier. This sort of abuse could be limited by restricting user enum to users who opt in; there could even be a special number range, from which users would be get numbers only if they opted in to user enum. However, restricting user enum to users who opt in merely limits this sort of abuse, without eliminating it, and reduces the potential market for user enum[85].
- User enum lets people try to change user information about others. The changes could be intended for “slamming” (transferring the service for a user to another service provider without consent) or for redirection, perhaps to steal traffic containing business information. Consequently users need to be authenticated before they change their information. Often the service provider to whom a number has been allocated and with whom the user has a billing relationship could do this authentication readily. However, the service provider might not help, believing that user enum wastes effort or even reduces revenue (by replacing phone calls by email, for example). Extra ways of authenticating users are needed, just as they are for carrier selection and number portability.
- Users who opt in to user enum are likely to keep their user information correct only until they stop using the numbers. Moreover, service providers may not check that the information is correct, especially when it applies to their former customers. If the system

[84] For example, a user having phone number +57 1 964 0235 might switch from using sip:person@one-isp.co.uk to using sip:person@another-isp.co.uk without telling other users: 3.5.2.0.4.6.9.1.7.5.e164.arpa would act as a domain name for the user.

[85] Users could also reduce the loss of privacy by imposing SIP called party control and providing only URIs containing SIP aliases, not their usual names, to DNS.

includes incorrect information then new “owners” of these numbers may be denied access or may have communications misdirected.

- Though user enum gives a new role to phone numbers (and to DNS, in a centralised implementation), the value of this is debatable, for the following reasons:
  - To use user enum, callers need to know phone numbers first. Directories indexed by the names of contacts are more generally useful, especially as they identify the communication services for an individual contact, not for all the people with which that contact shares the phone number.
  - By using user enum, callers may be able to find email URIs (for example) from phone numbers but they will not be able to find phone numbers from email URIs. Other services would be needed to supply such information.
  - Though user enum resembles a “find me / follow me” service (which lets calls track the locations and availability of users), it is not one, because DNS deliberately does not support rapid updating by users. Consequently any users wanting a “find me / follow me” service would need to get it separately and might not then bother to maintain their records in the user enum system.
  - Though user enum adopts phone numbers as a naming system, the names are not usually unique to particular individuals, at least for fixed access networks (in which all the members of a household share one number). Mobile numbering tends to be personal, but VOIP is currently associated more with fixed access networks than with mobile access networks. Personal numbering, when distinguishable from mobile numbering and nomadic numbering, has not been very successful so far. Consequently user enum is not always appropriate to holding personal preferences about communication services.

10.4 Recommendations for Colombia

Carrier enum helps with VOIP interconnection and therefore with the growth of competition. User enum, however, is much more questionable, for several reasons; generally regulators are therefore unwilling to impose it or even to propose it. We recommend:

1. Discouraging the deployment of user enum.
2. Encouraging the deployment of carrier enum, and the use of carrier enum to support number portability, by service providers, provided that:
   - User information is not accessible from the public internet.
   - Only numbers allocated in the national numbering plan are handled.
   - Service providers are not excluded from the system in an anti-competitive way.
   - Service providers in the group supply correct and complete user information, no matter which service providers are mentioned in the information.
3. Avoiding opening new non-geographic numbering ranges just for enum users.
4. Introducing, in consultation with service providers, suitable processes to help the migration of users between service providers, with the correct and speedy transfer of information for enum.

11 Cross-border aspects of numbering regulation

11.1 General aspects

CRT is interested in the possible use abroad of E.164 numbers from Colombia. Below we look at this from the following angles:

- The fraudulent international use of national numbers.
- The inappropriate international use of national numbers.
- The availability of numbers for dialling into Colombia.
- The allocation of numbers to users outside the expected geographical borders.

11.1.1 Fraudulent international use of national numbers

ITU-T Study Group 2 has expressed concern about misuse of numbering resources[86]. A secure website has been established for sector members to exchange information on problems detected and action taken to combat the problems[87].

To date reports posted on this site mainly relate to two kinds of misuse (generally using numbers from African or South Pacific country codes, though some also involving satellite operators' network codes). They are:

- Rogue internet dialling of international numbers.
- Postpaid mobile SIM card use for international calls.

These activities are generally criminal or perpetrated with criminal intentions. In some cases calls to the relevant numbers can be blocked or action can be taken to track down the perpetrators.

11.1.2 Inappropriate international use of national numbers

The concerns about the activities mentioned in Section 11.1.1 seem to have superseded the concerns of a few years ago over countries permitting use of parts of their numbering space for commercial activities with no real connection to that country[88]. A good example of this practice is Comoretel, which offers for sale internationally non-geographic services that use the numbering space +269 8. This space lies within that available under the Comores country code. (Slightly analogously, in Colombia there were at one stage internet domain names ending in uk.co and therefore resembling internet domain names ending in co.uk, as in the UK.)

Arguably non-geographic services like those from Comoretel are in competition with those available through the ITU country code for freephone and represent an abuse of an international resource that has been allocated to the country in trust. The argument about this could be as difficult to terminate as that about who really controls country codes for internet domain names.

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[86] See *Reporting of possible misuse of numbering resources*, ITU-T TSB Study Period 2005 Circular 9 (ITU, December 2004) at http://www.itu.int/md/T05-TSB-CIR-0009.

[87] See http://www.itu.int/ITU-T/secured/misuse/index.html.

[88] See *Use of national numbers for international services*, ITU-T TSB Study Period 2001 Circular 66 (ITU, October 2001) at http://www.itu.int/md/T01-TSB-CIR-0066.

There have also been international calls terminated inside or outside the apparent destination country and used for premium rate purposes that evade premium rate regulations. These calls do not provide consumer protection. In addition, when they are terminated outside the country they are often regarded as an abuse of numbering, because ITU country codes are intended to indicate destinations, not to indicate price bands. International operators may be able block international calls to narrow numbering ranges automatically; if not, they may need to handle all calls to the destination country manually.

11.1.3 Cross-border access to non-geographic services

In their eleventh report on the implementation of the European regulatory framework, EU staff express disappointment at the failure of countries to make all non-geographic services available across borders[89]:

> The Commission services are concerned about difficulties that have arisen concerning the ability of end-users to access non-geographic numbers (for instance freephone or shared cost numbers, where the called party pays all or part of the total cost of the call) across borders.
>
> Access to non-geographic numbers can help to ensure that the single market becomes a reality for the millions of European citizens who travel, live or work in other countries of the Union. Facilitating this movement contributes to economic and social development in the Member States and to the attainment of a true Single Market. So far, it appears that very few such numbers can actually be called from another EU country. This is particularly worrying as non-geographic numbers at national level are increasingly being advertised and used in order to contact government services, financial organisations and public utilities. The Commission service are also concerned that subscribers of Voice over IP services who have been allocated non-geographic numbers may not receive calls from other EU countries.
>
> There does not seem to be any significant technical barrier to ensuring that non-geographic numbers can be accessed across borders, with one exception: Ireland would have to change the Dublin area code to enable cross-border access to other European freephone numbers[90]. From an economic point of view, there is no reason why operators would not be able to agree on a revenue-sharing mechanism for a vast majority of non-geographic numbers. In this case, the normal charge made to the consumers should cover the costs of both parties.
>
> The Commission services expect NRAs to intervene proactively in the coming months so as to ensure that this important issue is resolved and that calling such numbers from all Member States becomes a reality for European consumers in the context of achieving a true Single Market.

Similar concerns may arise in Latin America, and again firm regulatory requirements could deal with them. This study has not looked at technical barriers, but expects that as in Europe these are few and can be overcome. Regulatel seems an excellent vehicle for doing this.

We mention in Section 5.3 and Section 8.3 methods by which, if they obeyed certain rules, short codes could be transformed automatically into appropriate non-geographic numbers and thereby made available nationally and internationally.

11.1.4 Out-of-area geographic numbers

Some operators offer the option of receiving calls routed through locations that have numbers with geographic significance but that are not the location of the called party. The numbers may signify locations in a different country from the called party or in the same

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[89] See *Volume I of the Annex to the European Electronic Communications Regulation and Markets 2005 (11th Report)* (Commission of the European Communities, February 2006) at http://europa.eu.int/information_society/policy/ecomm/doc/implementation_enforcement/annualreports/11threport/sec_2006_193-vol1.pdf

[90] The nature of this technical barrier is obscure to us (the consultants). We suspect that this passage may reflect a misunderstanding.

country but a different geographic area from the called party. Calls can then be made at the tariffs for the locations signified by the numbers, instead of at the tariffs for the location of the called party. Several VOIP service providers, in particular, offer this option, though in some countries (such as the UK) it is also available through traditional fixed telephony operators.

The customer can choose the numbers (and the corresponding locations) from the number blocks that are allocated to the operator. For example:

- Skype is offering numbers in Australia, Brazil, Denmark, Estonia, Finland, France, Germany, Hong Kong, Japan, Poland, Sweden, Switzerland, the UK and the US.
- Vonage is offering numbers in Canada, France, Ireland, Italy, Mexico, Spain, the UK and the US.

Both Skype and Vonage underline the benefit to the customer of 'virtual numbering' providing a 'virtual presence' in a different country or a different area of the same country: it lets friends, family or customers there make calls to the customer at local tariffs. Most of the countries mentioned are raising no objections to this practice, although some require the customers to accept local terms and conditions or to say that they reside in the country or area.

As yet ITU-T has no agreed opinion on this 'virtual numbering'. In practice, decisions about it are being left to individual administrations. (The regulator in Ireland, for example, sees no reason either to encourage it or to discourage it.) Of course, such numbers provide international or national bypass, so the countries allowing them without restriction are generally fully liberalised with low international and national prices.

Usually 'virtual numbering' intensifies pressures on geographic numbering space. The pressure is reduced if either long distance calls or calls to non-geographic numbers with well-known NDCs can be made at tariffs close to those for local calls.

11.2 Recommendations for Colombia

In practice 'virtual numbering' is likely to persist while there are major discrepancies between tariffs. We do not immediately see that it is contrary to the interests of Colombia, or indeed the world in general. However, CRT may want some clarification, especially if it wishes to promote the use of such numbers actively. We recommend:

1. Considering submitting to ITU a request for clarification about the allocation of numbers from the national numbering space to persons outside the country.
2. Permitting the allocation of numbers from the national numbering space to persons outside the country, at least if there are no revenue sharing (premium rate) arrangements.

12 Practices in number allocation

12.1 General aspects

CRT has official responsibility for granting numbering resources to operators. There are exemplary published records of allocated blocks[91]. CRT also holds records of actual number utilisation based on twice-yearly returns from operators.

We were asked to suggest appropriate practice on the following related topics:

- The criteria for eligibility for applying for numbering from the regulator or service providers.
- The relations between number allocation and rule enforcement.
- The criteria for deciding how many numbers to allocate to an applicant.
- The ways of choosing the numbers to be allocated to an applicant.

12.1.1 Eligibility for numbering

For convenience we say that:

- Primary allocation is allocation of numbers by the regulator to a service provider that is eligible to have such an allocation.
- Secondary allocation (sometimes called 'sub-allocation') is allocation of numbers by a service provider to another service provider.

Any organisation that intends to provide publicly available telephony services must be able to obtain numbers, through primary or secondary allocation, provided that the organisation is not identified as unsuitable by the regulator.

In deciding who is to be eligible for primary allocations, the regulator has to strike a balance. On the one hand, the regulator needs to know how much of the numbering space is being used and whether the numbers are being used properly; also, the regulator may suspect that some operators will be unwilling to provide secondary allocations fairly and speedily. On the other hand, the regulator must not be burdened by many applications for small quantities of numbers that could be provided more economically and conveniently through secondary allocation. In particular:

- Public phone operators may want only few numbers in each of many different geographic areas, so to give each of them primary allocations would waste many thousands of numbers. In each of those areas the public phone operators may need to discuss interconnection with different access network operators. Their discussions could be extended to include allocation and routing of numbers.
- Value added service providers may want only few numbers for users of minority languages or for limited periods of time (to provide world cup results, for example). The administrative burden on the regulator would be relieved if such numbers could come from existing primary allocations.

The service providers that are eligible to have primary allocations of numbers could be chosen in various ways. They could be, for example:

- All holders of individual (rather than class) licences.
- All service providers able to justify requests for blocks of 1 000 or more numbers.

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[91] See http://www.siust.gov.co/siustpru.

- All service providers providing access services to end users.
- All service providers (so there are no secondary allocations).

The choice to be made here is largely one of keeping the workload of the regulator manageable, provided that the regulator can monitor and control what happens to the numbers once they are allocated. The choice is not based on the distinction between network operators and other service providers, for example: that distinction is difficult to define when service providers may lease partitions of exchanges or transmission links. In particular VOIP service providers can be eligible for primary allocations.

To achieve effective monitoring and control, the regulator can require that:

- Any service provider that has obtained a primary allocation may make secondary allocations from the primary allocation.
- Any service provider that has obtained an allocation will make secondary allocations from that allocation fairly and speedily, after receiving justified applications from other service providers that are eligible for secondary allocations.
- Any service provider is eligible for secondary allocations if he is not eligible for primary allocations and has not been identified by the regulator as being unsuitable (perhaps because of earlier violations of terms and conditions or other regulations).
- The terms and conditions imposed by the regulator on a primary allocation will be incorporated in the terms and conditions on all secondary allocations made from that primary allocation.
- If the terms and conditions imposed by the regulator are violated by the holder of a secondary allocation then the holder of the allocation from which the secondary allocation was made may be required by the regulator to take fast action (such as blocking calls to, withholding payments to, or withdrawing allocations from a premium rate service provider).
- Each service provider will be responsible for reporting to the regulator on the utilisation of its primary allocations (and therefore of the secondary allocations made from those primary allocations) at whatever level of granularity the regulator finds useful.
- If a service is withdrawn from all its customers the holder of the (primary or secondary) allocations of numbers for the service will return the numbers to the organisations that made the allocations.

Service provider number portability raises the problem of which service provider holds numbers after they have been ported (from a donor network to a recipient network): there could be either a secondary allocation of the numbers from the donor network to the recipient network or a transfer of the original (primary or secondary) allocation of the numbers from the donor network to the recipient network. If secondary allocations are subject to all the terms and conditions imposed on the primary allocations from which they are drawn, these ways of handling the ported numbers should be formally equivalent. The first of them probably entails less work when the number is ported for the first time, but requires successively more work when the number is ported repeatedly. When service provider number portability is first introduced the first may be the better way of handling the ported numbers; if service provider number portability becomes very popular, however, the second may deserve to be adopted as well or instead of the first[92].

[92] There is an analogy here with the network implementation of service provider number portability, where involving donor networks in the treatment of calls to ported numbers is probably cheaper for low proportions of calls to ported numbers.

12.1.2 Rule enforcement

There can be confusion about whether in a liberalised market, with telecommunications licences (or authorisations) available to anyone that wants them, the regulator is entitled to refuse applications for numbers (except on grounds of shortage or of the mismatch between the NDC requested and the intended use): if anyone is allowed to set up a publicly available telephony service, then perhaps anyone should be able to obtain numbers for the service. For example, in the UK in 2004 the regulator stated that EU directives meant that regulators could not refuse applications for allocations, but by 2006 the regulator was intending to refuse applications from service providers that had violated consumer protection standards[93].

Even where applications cannot be refused, terms and conditions can still be imposed on primary allocations to prohibit misuse of numbers and indicate that calls to numbers will be blocked if the terms and conditions are violated. These terms and conditions can then be incorporated in the terms and conditions on all secondary allocations made from the primary allocations.

The regulator can then require a service provider that has obtained a number in a primary allocation to block calls to that number. However, the service provider is not necessarily a network operator and may therefore have limited ability or inclination to block calls. The regulator may therefore have an additional power, to require all service providers to block calls to particular numbers. Among those service providers will be responsible network operators, who will block calls when required to do so. The regulator may not even need an explicit power to achieve this: it may be enough in practice to ask all the dominant network operators, who are obliged to offer interconnection to other network operators, to do it.

We suggest this treatment to avoid, if possible, complex discussions about what a network operator is, about when the regulator is entitled to refuse applications for allocations, and about whether the regulator needs to obtain new legal powers.

12.1.3 Allocation sizes

In many countries geographic numbers are normally allocated in blocks of 10 000 or perhaps 1 000 (where conservation measures are being applied). For VOIP service providers 1 000 numbers may be enough for initial trials or minor deployments.

In many countries mobile numbers are allocated in blocks of 1 million or even 10 million. However, new fixed access network operators are quite likely to use wireless access, so with fixed-mobile convergence they will also be mobile access network operators. Such operators may be small and not need 1 million numbers. Allocations of 10 000 or 100 000 may be more suitable.

Normally the existing number holdings of a service provider must be well utilised before applications for more capacity are granted. The utilisation of geographic numbering space can reach 60% but may need to be lower (because of splits between exchanges, for example)[94]. In Colombia, however, it can reach 70%, as Figure 3 shows, and operators could be encouraged to reach some such target.

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[93] The regulator had taken legal advice (at least on the earlier occasion) and the EU directives had not changed. See *The Regulation of Premium Rate Services - An Ofcom Report for DTI* (Ofcom, December 2004) at http://www.ofcom.org.uk/telecoms/ioi/nwbnd/prsindex/ntsprsdti/prs_review.pdf and *Telephone Numbering - Safeguarding the future of numbers* (Ofcom, July 2006) at http://www.ofcom.org.uk/consult/condocs/numberingreview/statement/statement.pdf.

[94] In Singapore, the utilisation of geographic numbering and the utilisation of mobile numbering are generally required to reach 85% and 70% (respectively) except when numbers are allocated through auctions. However, the utilisation of numbering for direct inward dialling (which is essentially corporate numbering) is only required to reach 50.

The utilisation of mobile numbering is also limited, often by the churn in prepaid customers. However, currently there is no shortage of mobile numbers in Colombia.

For specially tariffed numbering, lower levels of utilisation may sometimes be appropriate, because information services that aim to have mass markets will seek memorable numbers. Probably there are at most 500 000 memorable numbers for each non-geographic NDC[95].

Asking for justification in applications for allocations, and withdrawing unused allocations, will usually be enough to ensure that numbers are not wasted. (When the current utilisation of the blocks already allocated, or the expected utilisation of the blocks in the application, is below 50%, the applicant would be asked to explain why a higher utilisation was not achievable.)

Figures for utilisation could be required for blocks smaller than the whole allocation (for example, for blocks of 1 000 in an allocation of 10 000) to ensure that service providers are not fragmenting the numbering space unnecessarily or creating artificial shortages for competitors.

ITU-T recommendation E.164 specifies that 7 digits of the ISN, including the country code, should suffice to determine the international gateway exchange to which calls are routed in the destination country. (However, a service provider in the destination country could arrange that particular international gateway exchange operators in the originating country allowed more than 7 digits of analysis, or could bypass the international gateway exchanges by using VOIP from the originating country.) In Colombia at present this indicates that each number in a block of 1 000 (8-digit) geographic numbers or 100 000 (10-digit) non-geographic numbers receives international calls through the same international gateway exchange. If geographic numbers are lengthened or smaller blocks are allocated service providers need to be made aware of this slight constraint on their sources of revenue.

12.1.4 Allocation choices

Number blocks are usually allocated so as to be contiguous, with the intention of avoiding fragmentation. Any gaps between allocated number blocks are due to the need to start a block of size 10^n on a boundary between blocks of size 10^m where m is at least n.

Number blocks can contain some numbers that are more memorable than others. Usually the blocks are large enough that two blocks of the same size have very similar proportions of memorable numbers. However, one block may still be more desirable than the other because of its location in the numbering range; for example, the block of 10 000 numbers that begins at 800 000 0000 may be more desirable than the block that begins at 800 295 0000. This difference in desirability can be reduced by withholding numbering blocks that have locations that begin at memorable numbers, such as 800 000 0000 or 800 008 0000.

However, more significant than the desirability of a number block is the ease of memorising an individual number (whether an E.164 number, a short code or a carrier selection code). The number chosen for a service may provide an advantage to the service provider. If there are enough equally memorable numbers available to satisfy all the potential service providers, this advantage may be negligible. If there are not enough equally memorable numbers then customers may ultimately pay for the ease of memorising the number by getting a service that has higher prices or lower quality than competing services (as noted in Section 7.3). In such circumstances there is a case for withholding memorable numbers.

In deciding whether to withold memorable numbers the regulator has to weigh the loss to the public of doing so against the advantages to the organisations that would be allocated them.

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[95] For example, a block of 1 million numbers contains 1 100 numbers having 2 identical 3-digit groups or 3 identical 2-digit groups.

Individual numbers (or indeed whole number blocks) might be allocated through various mechanisms mentioned in Section 6.4. Different allocation mechanisms may be appropriate in different circumstances. In particular:

- Selections of numbers may be made by potential number holders if there is no concern about the advantages obtained by holding them. (This might be because the numbers in the number pool have approximately the same 'quality', so they are approximately equally memorable.)
- Beauty contests are perhaps best turned into requirements for qualifying for entry to other contests (such as the contests for holding 113 in Section 7.3) that might be decided by markets or by chance. On their own they can appear insufficiently objective.
- Auctions are not very suitable for allocating individual E.164 numbers within larger number blocks if there is no number portability, as they emphasise to the winners "ownership" of the numbers (or at least "ownership" of rights to use the numbers). They may be suitable for allocating short codes or carrier selection codes, but they tend to favour incumbents and large new entrants. They can be complicated (because, for example, they need to make collusion difficult but make participation easy)[96].
- Lotteries of numbers may be held if there is no concern about the advantages obtained by holding them.

There are personal and cultural differences in which numbers are regarded as memorable. The personal differences may be difficult to codify, but the cultural differences can be codified[97]. Also, widespread opinions can be formalised: we give one possible set of rules for 4-digit numbers in Section 8.2.3. (The corresponding rules for 3-digit numbers produce 35 'gold' numbers, 325 'silver' numbers and 640 'nickel' numbers.)

12.2 Recommendations for Colombia

We recommend:

1. Issuing explicit rules about the utilisations expected in existing numbering blocks before new allocations will be made.
2. Introducing demonstrably fair allocation mechanisms for potentially distinctive numbers.
3. Imposing conditions on allocations to prohibit misuse of numbers and to indicate that calls to numbers will be blocked by service providers if the conditions are violated.
4. Exploring with the industry whether introducing secondary allocation would lead to more streamlined regulation without compromising monitoring and control by the regulator.
5. Avoiding trading in individual numbers in NDCs that do not offer number portability.

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[96] See "What Really Matters in Auction Design", *Journal of Economic Perspectives*, volume 16, number 1, Winter 2002, pages 169-189 (by Paul Klemperer) at http://www.nuff.ox.ac.uk/users/klemperer/VirtualBook/wrm6.pdf.

[97] In Singapore, each block of 10 000 numbers is regarded as containing 486 golden numbers. The golden numbers are 10 having 4 occurrences of one given digit, 180 others having 3 adjacent occurrences of one given digit, 270 others having 2 occurrences of each of two given digits, 16 others having 3 occurrences of 8 and not mentioning 5, 5 others starting with 1 and ending with 88 (1288, 1388, 1688, 1788 and 1988), 3 others starting with 1 and ending with 8 (1168, 1628 and 1668), 1234 and 3268.

13 Recommendations

Geographic numbers

1. Safeguarding the possibility of making available more geographic numbering space where and when it is needed by:
   - Reserving all unopened blocks in the 9xx xxxx range of NDC 1 (except those of the form 90x xxxx or 91x xxxx).
   - Reserving all unopened blocks in the 9xx xxxx range of NDC 2 (except those of the form 90x xxxx or 91x xxxx).
   - Reserving all unopened blocks in the 9xx xxxx range of NDC 4 (except those of the form 90x xxxx or 91x xxxx).
2. Safeguarding the possibility of making available more non-geographic numbering space by:
   - Reserving all non-geographic numbers with 60Y and 61Y NDCs and reserving the 2xx xxxx, 4xx xxxx, 5xx xxxx and 6xx xxxx ranges of NDC 6.
3. Ensuring that allocations of geographic numbers are well utilised before more are allocated.
4. Withdrawing formally the geographic numbering changes in Decree 25 of 2002.
5. Reviewing capacity demand trends annually.

Non-geographic numbers

1. Safeguarding the possibility of making available more non-geographic numbering space by:
   - Reserving all non-geographic numbers with 60Y and 61Y NDCs and reserving the 2xx xxxx, 4xx xxxx, 5xx xxxx and 6xx xxxx ranges of NDC 6.
2. Safeguarding the possibility of allocating non-geographic numbers in classes according to tariff by:
   - Reserving all non-geographic numbers with 10Y, 11Y, 20Y, 21Y, 40Y, 41Y, 50Y, 51Y, 70Y and 71Y NDCs.
   - Reserving all non-geographic numbers with 8XY NDCs other than 800.
   - Reserving all non-geographic numbers with 9XY NDCs other than 900, 901, 947 and 948.
3. Consulting the industry and consumer groups about non-geographic numbering classes, dealing with, in particular:
   - Which kinds of information should be embedded in NDCs.
   - How many price ceilings for non-geographic numbers would be needed, and how many numbers would be needed for each price ceiling.
   - How many lengths of non-geographic numbers would be needed, and how many numbers would be needed for each length.
   - Which distinctive NDCs should be adopted.
   - Which current numbers should be moved to fit the distinctive NDCs.

4. Exploring the potential demand among businesses for non-geographic number blocks with number portability.
5. Reviewing the consumer protection arrangements for premium rate services, particularly as these services may become converged services.
6. Reviewing capacity demand trends annually.

Converged services

1. Allowing all services to have geographic numbers provided that:
   - All calls to the numbers have call charges at or below those for the geographic tariff packages of the callers.
   - Any respects in which the services do not meet user expectations of traditional geographic services are clearly described to customers, both at the point of sale and in regular communications from the service providers.
2. Consulting the industry and consumer groups about numbering for converged services, dealing with, in particular:
   - Whether VOIP service providers could reasonably be required to implement number portability if they are to gain access to certain number ranges.
3. Reviewing capacity demand trends annually.

Short codes

1. Requesting from all operators figures for the utilisation of each short code.
2. Reviewing with the sponsoring public organisation of each short code the meaning, treatment of answered calls and continuing value of the short code.
3. Imposing strict requirements (such as essential relevance to safety, minimum levels of utilisation, uses related to telecommunications or uses unsuitable for just E.164 numbers) to justify obtaining or retaining short codes.
4. Consulting the industry and consumer groups about the short code space structure, dealing with, in particular:
   - Whether having most one 1XY code per operator would be feasible.
   - Which other short codes should be used for which purposes in a restructured short code space.
   - Which short codes should be in a set of common service codes for parallel use by all fixed and mobile access network operators.
   - What other harmonisation between short codes on fixed and mobile phones (including those using * and #) would be feasible.
   - Whether an automatic transformation of short codes into non-geographic E.164 numbers would be useful.
   - Whether delegated management of short codes, within the overall national numbering plan, would be desirable.
5. Introducing incentives to utilising short codes well, such as:
   - Imposing levels of charging for obtaining and retaining short codes.
   - Abolishing charging modality 3 (thereby also improving tariff transparency).

Carrier selection

1. Investigating the number and size of potential investments in long distance networks.
2. Consulting the industry and consumer groups about making 01 or 03 available for other purposes, dealing with:
   - Whether 01 should be replaced by 03 or 03 should be replaced by 01 after a period of parallel running.
3. Exploring with the industry, including potential new entrants, measures that together would be acceptable to all parties and provide carrier selection codes that would protect the brands of existing operators and be fair to new operators.
4. Letting resellers be accessible by carrier selection.
5. Introducing preselection with attention to the factors that contribute to its effectiveness, in the light of the discussions with the industry.

Short codes for directory enquiry services

1. Consulting with the industry and consumer groups about an alternative to the currently proposed change in meaning of 113 and 130, dealing with:
   - Whether directory enquiry service providers should need to satisfy qualifying requirements if they wish to hold 113.
   - Whether both local directory enquiry services and national directory enquiry services should use 130.
   - Whether there should be a limit on the period during which a directory enquiry service provider need not offer national information.
2. Making available codes for 100 or 1000 possible directory services (some of which would be reserved or withheld), with the choice between them to be made when the applications for codes have been submitted and demand can be estimated well.
3. Reviewing the consumer protection arrangements for directory enquiry services, in the light of the similarity of these services to other value added services.

Short codes due to mobile phones

1. Consulting the industry and consumer groups about the SMS and MMS short code space structure, dealing with, in particular:
   - Which short codes should be in a set of common service codes for parallel use by all fixed and mobile access network operators.
   - What other harmonisation between short codes on fixed and mobile phones (including those using * and #) would be feasible.
   - Whether an automatic transformation of short codes into non-geographic E.164 numbers would be useful.
   - Whether delegated management of short codes, within the overall national numbering plan, would be desirable.
2. Reviewing the consumer protection arrangements for value added services, bearing in mind the possibilities for barring messages, introducing messages about tariffs, and assigning tariff or content information to numbering subranges.

3. Monitoring the development of USSD short codes to determine whether they should be subject to the same regulation as SMS and MMS short codes.

Number portability

1. Checking that any network implementations of service provider number portability that are adopted interwork economically for services that can occupy the same numbering range.
2. Attending to all the other factors that contribute to the effectiveness of service provider number portability when introducing it.
3. Encouraging the adoption of portability for identifications other than phone numbers.
4. Introducing, in consultation with service providers, suitable processes to help the migration of users between service providers, with the correct and speedy transfer of information for service provider number portability.

ENUM

1. Discouraging the deployment of user enum.
2. Encouraging the deployment of carrier enum, and the use of carrier enum to support number portability, by service providers, provided that:
   - User information is not accessible from the public internet.
   - Only numbers allocated in the national numbering plan are handled.
   - Service providers are not excluded from the system in an anti-competitive way.
   - Service providers in the group supply correct and complete user information, no matter which service providers are mentioned in the information.
3. Avoiding opening new non-geographic numbering ranges just for enum users.
4. Introducing, in consultation with service providers, suitable processes to help the migration of users between service providers, with the correct and speedy transfer of information for enum.

Cross-border aspects of numbering regulation

1. Considering submitting to ITU a request for clarification about the allocation of numbers from the national numbering space to persons outside the country.
2. Permitting the allocation of numbers from the national numbering space to persons outside the country, at least if there are no revenue sharing (premium rate) arrangements.

Practices in number allocation

1. Issuing explicit rules about the utilisations expected in existing numbering blocks before new allocations will be made.
2. Introducing demonstrably fair allocation mechanisms for potentially distinctive numbers.
3. Imposing conditions on allocations to prohibit misuse of numbers and to indicate that calls to numbers will be blocked by service providers if the conditions are violated.
4. Exploring with the industry whether introducing secondary allocation would lead to more streamlined regulation without compromising monitoring and control by the regulator.
5. Avoiding trading in individual numbers in NDCs that do not offer number portability.

Annex A Companies and organisations contributing to the study

Government bodies

CRT
Ministerio de Comunicaciones
SSPD

Fixed operators

ETB
EPM
Colombia Telecommunicaciones
Orbitel
TV Cable
Telmex

Mobile operators

Telefonica Móviles
Comcel
Colombia Móvil
Avantel

Associations

Andesco
Asonet
Asocel

Annex B Numbering in selected Latin American countries

Country	Population in 2005 (millions)	GDP per capita in 2004 (US$)	Fixed teledensity in 2005	Mobile teledensity in 2005	Fixed access network operators	Mobile access network operators	Long-distance operators
Argentina	38.6	4007	23.2	57.4			112
Brazil	186.4	3338	23.5	46.2			
Chile	15.6	6108	22.0	67.8			50
Colombia	45.6	2141	17.1	47.8	40	3	3
Ecuador	13.2	2295	12.9	47.2			
El Salvador	6.8	2240	14.1	35.1	9	5	15
Mexico	107.0	6328	18.2	44.3	23	15	22
Panama	3.2	4477	13.6	41.9			57
Peru	28.0	2476	8.3	20.5	5	3	21
Venezuela	26.7	4164	13.5	46.7			10

Table 1 Basic statistics

Country	NSN length	NDC + SN lengths	Number of NDCs of each length	Local dialling (without NDC)	First digit of NDC	First digit of SN	Number portability
Argentina	10 10 10	2 + 8 3 + 7 4 + 6	1 20 279	Yes	1 to 3	2 to 9	
Brazil	10	2 + 8	69	Yes	1 to 9	2 to 6	Yes
Chile	8 8, 9	1 + 7 2 + 6, 2 + 7	1 23	Yes	2 to 7	2 to 9	To be decided
Colombia	8	1 + 7	7	Yes	1, 2, 4 to 8	2 to 9	To be decided
Ecuador	8	1 + 7	6	Yes	2 to 7	2 to 9	
El Salvador	8	1 + 7	2	No	2	1 to 9	No
Mexico	10 10	2 + 8 3 + 7	3 400	Yes	2 to 9	1 to 9	To be studied
Panama	7	7	-	No	2 to 5, 7, 9	As NDCs	
Peru	8 8	1 + 7 2 + 6	1 23	Yes	1, 4 to 8	2 to 8	To be decided
Venezuela	10	3 + 7	83	Yes	2	2 to 9	

Table 2 Geographic numbering

Country	NSN length	Mobile number identification	Dialling from fixed to mobile	Other special dialling from mobiles	Number portability
Argentina	10	No special identification.	New prefixes to NSN for calls to mobiles with CPP: national: 15, international: 9		
Brazil	10	SNs start with 7, 8 or 9.	Prefix 90 to NSN for calls to mobiles with CPP.		Yes
Chile	9	NDCs start with 9.			To be decided
Colombia	10	NDCs start with 3.	Prefix 03 to NSN.	Prefix 03 to NSN for mobile to fixed (not for mobile to mobile). Short codes start with * or #.	To be decided
Ecuador	8	NDCs start with 9.			Yes
El Salvador	8	NDC is 7.	No prefix needed.		To be decided
Mexico	10	No special identification.	New prefixes to NSN for calls to mobiles with CPP: national: 044 international: 1	*xxx short codes	To be decided
Panama	7	SNs start with 6.			
Peru	9	SNs start with 9.	No prefix needed	*1xx short codes	To be decided
Venezuela	10	NDCs start with 4.			

Table 3 Mobile numbering

Country	Freephone format	Premium rate format	Shared cost format	Other special service format	Reserved for future non-geographic services	Number portability
Argentina	0 800 xxx xxxx	0 600 xxx xxxx			0 6YZ, 0 9YZ	
Brazil	0 800 xxx xxxx	0 900 xxx xxxx				
Chile	800 xxx xxx	700 xxxx				
Colombia	01 800 xxx xxxx	01 90Y xxx xxxx (Y not 0)	01 900 xxx xxxx, 01 91Y xxx xxxx	01 94Y xxx xxxx (Y = 0, 7, 8): internet and other data access		To be decided
Ecuador	1 800 xxx xxx	1 900 xxx xxx	1 700 xxx xxx			
El Salvador	800 xxxx, 800 xxxx xxxx	900 xxxx, 900 xxxx xxxx		801 xxxx: calling card services 91Y xxxx xxxx: government uses		Yes
Mexico	01 800 xxx xxxx	01 900 xxx xxxx	01 300 xxx xxxx	01 200 xxx xxxx: rural satellite telephone	01 X0Z (X not 0)	
Panama	800 xxxx	900 xxxx				
Peru	0 800 xxxxx	0 808 xxxxx	0 801 xxxxx:			
Venezuela	0 800 xxx xxxx	0 900 xxx xxxx				

Table 4 Specially tariffed services numbering

Country	Default prefixes	CICs	Call-by-call selection format from fixed phones	Call-by-call selection format from mobile phones	Pre-selection
Argentina	0, 00	XYZ (X = 1, 2, 3)	17 + CIC + NSN, 18 + CIC + ISN		Yes
Brazil		XY (X not 0, Y not 0, X not Y)	0 + CIC + NSN, 00 + CIC +ISN		
Chile	0, 00	XY (X = 1, 2, 5, 7, 8)	1 + CIC + NSN, 1 + CIC + 0 + ISN		Yes
Colombia	01	X (X = 5, 7, 9)	0 + CIC + NSN, 00 + CIC + ISN	As from fixed phones, plus #xxx options	No
Ecuador					
El Salvador		XY (X = 4, 5, 6, 7, 8)	1+ CIC + NSN, 1+ CIC + 00 + ISN		No
Mexico	01, 00	XYZ (X not 0)	010 + CIC + NSN, 000 + CIC + ISN	As from fixed phones	Yes
Panama		XY (X not 0)	0 + CIC + NSN, 0 + CIC + 00 + ISN		
Peru	0	XY	19 + CIC + 0 + NSN, 19 + CIC + 00 + ISN	As from fixed phones	Yes
Venezuela	0	XY	01 + CIC + NSN, 01 + CIC + 0 + ISN		Yes

Table 5 Carrier selection

Country	Primary emergency code	Other emergency codes	Community service codes on all access networks	Directory information code	Other operator service codes with similar meaning on all access networks	Access to a service of a different operator
Argentina	911	10Y, 128 (Mercosur)	13Y	110	11Y, 12Y, 15, 19	
Brazil	190, 192, 193	128 (Mercosur)	14XY, 15XY	102	10Y	
Chile	13Y				12Y, 18Y	
Colombia	123	112, 119	Several 1XY short codes	113	10Y (Y = 0, 1, 2, 3) for local operators	Dedicated 1XY short codes for all long distance and mobile operators
Ecuador						
El Salvador	911	121, 122, 123	117: time	1 + XY + 114	1+ XY + 115	
Mexico	066	06X, 08X	070	040	0X0 (X not 0, X not 1)	
Panama	911					Dedicated 1XY short codes for all operators
Peru	105, 116, 117	111, 115		103	101, 102, 104, 108, 109	
Venezuela	171		119: time	113	155, 151, 122	

Table 6 Particular short codes

Annex C Main references

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Annex D Parts of Chapter 14 of the draft Free Trade Agreement

Article 14.3

Number Portability

3. Each Party shall ensure that suppliers of public telecommunications services in its territory provide number portability to the extent technically feasible, on a timely basis, and on reasonable terms and conditions. (Footnote: In complying with this paragraph, any Party other than the United States may take into account the economic feasibility of providing number portability.)

(number portability means the ability of end-users of public telecommunications services to retain, at the same location, the same telephone numbers without impairment of quality, reliability, or convenience when switching between like suppliers of public telecommunications services;)

Dialing Parity

4. Each Party shall ensure that suppliers of a particular public telecommunications service in its territory provide dialing parity to suppliers of the same public telecommunications service of the other Party and provide suppliers of public telecommunications services of the other Party non-discriminatory access to telephone numbers, directory assistance, directory listing, and operator services with no unreasonable dialing delays.

(dialing parity means the ability of an end-user to use an equal number of digits to access a particular public telecommunications service, regardless of the public telecommunications service supplier chosen by such end-user;)

Article 14.10

Allocation and Use of Scarce Resources

1. Each Party shall administer its procedures for the allocation and use of scarce telecommunications resources, including frequencies, numbers, and rights-of-way, in an objective, timely, transparent, and non-discriminatory manner.

2. Each Party shall make publicly available the current state of allocated frequency bands but shall not be required to provide detailed identification of frequencies allocated for specific government uses.

3. A Party's measures allocating and assigning spectrum and managing frequencies are not measures that are per se inconsistent with Article 11.4 (Market Access), either as it applies to cross-border trade in services or, through the operation of Article 11.1.3 (Scope and Coverage), to a covered investment of another Party. Accordingly, each Party retains the right to establish and apply its spectrum and frequency management policies that may have the effect of limiting the number of suppliers of public telecommunications services, provided that it does so in a manner that is consistent with other provisions of this Agreement. This includes the ability to allocate frequency bands, taking into account current and future needs and spectrum availability.

Article 14.6

Conditions for the Supply of Information Services

1 No Party may require an enterprise in its territory that it classifies as a supplier of information services and that supplies those services over facilities that it does not own to:

(a) supply those services to the public generally;

(b) cost-justify its rates for those services;

(c) file a tariff for those services;

(d) connect with any particular customer for the supply of those services; or

(e) conform with any particular standard or technical regulation for connecting to any network, other than a public telecommunications network.

2. Notwithstanding paragraph 1, a Party may take the actions described in subparagraphs (a) through (e) to remedy a practice of a supplier of information services that the Party has found in a particular case to be anti-competitive under its law or regulations, or to otherwise promote competition or safeguard the interests of consumers.

Rural Telephone Suppliers - Colombia

1. Colombia may designate and exempt a rural telephone company that has at least 80 percent of its total fixed subscriber lines in operation in rural areas from the obligations contained in paragraphs 2 through 4 of Article 14.3 and the obligations of Article 14.4. The total number of subscriber lines supplied by a rural telephone company includes all subscriber lines supplied by the company and by its owners, subsidiaries, and affiliates.

2. Colombia may exempt service suppliers that supply public telecommunications services in rural areas from the obligations contained in paragraphs 2 through 4 of Article 14.3 and from the obligations contained in paragraphs 3, 4, 6, and 7 of Article 14.4. Any exemption is applicable only with respect to the public telecommunications services supplied in rural areas.

3. For purposes of this Chapter, a rural area in Colombia is defined as a municipality with a total number of installed fixed lines of 4,500 or less.

4. The combined areas that Colombia designates as rural areas may not contain more than ten percent of the total number of fixed subscriber lines installed in its territory.

5. Nothing in this Annex shall be construed to preclude Colombia from imposing the requirements set out in Articles 14.3 and 14.4 on a rural telephone supplier.

Annex E Abbreviations

CC	Country Code
ccTLD	country code Top Level Domain
CEPT	European Conference of Postal and Telecommunications Administrations
CIC	Carrier Identification Code
CLI	Calling Line Identification
CRT	Comisión de Regulación de Telecomunicaciones
CSC	Carrier Selection Code
DECT	Digital Enhanced Cordless Telecommunications
DNS	Domain Name System
ECC	Electronic Communications Committee (the current telecommunications organisation for CEPT)
ECTRA	European Committee for Telecommunications Regulatory Affairs (the former telecommunications organisation for CEPT)
ENUM	tElephone NUmber Mapping
ERO	European Radiocommunications Office (the current telecommunications office for CEPT)
ETO	European Telecommunications Office (the former telecommunications office for CEPT)
ETSI	European Telecommunications Standards Institute
EU	European Union
GAC	Government Advisory Committee
GSM	Global System for Mobile communications
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
ICSTIS	Independent Committee for the supervision of Standards of Telephone Information Services
IMSI	International Mobile Station Identity
IN	Intelligent Networking
IP	Internetwork Protocol
IPTV	IP TeleVision
IPv4	IP version 4
IPv6	IP version 6
ISDN	Integrated Digital Subscriber Network
ISN	International Significant Number
ISP	Internet Service Provider
ITU	International Telecommunication Union
ITU-D	ITU – Telecommunication Development Sector
ITU-T	ITU – Telecommunication Standardisation Sector
IVR	Interactive Voice Response
LIR	Local Internet Registry
MAC	Media Access Control
MMS	Multimedia Messaging Service
MVNO	Mobile Virtual Network Operator
NANP	North American Numbering Plan
NANPA	NANP Administration
NAPT	Network Address and Port Translation
NDC	National Destination Code

NGN	Next Generation Network
NSN	National Significant Number
OECD	Organisation for Economic Co-operation and Development
Ofcom	Office of Communications (the current UK telecommunications regulator)
Oftel	Office of Telecommunications (the former UK telecommunications regulator)
RIPE	Réseaux IP Européens
RIR	Regional Internet Registry
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SMS	Short Messaging Service
SN	Subscriber Number
SPC	Signalling Point Code
STP	Signalling Transfer Point
UK	United Kingdom
UMA	Unlicensed Mobile Access
UPT	Universal Personal Telecommunications
URI	Uniform Resource Identifier
US	United States
USSD	Unstructured Supplementary Service Data
VAS	Value Added Service
VOIP	Voice Over IP
VPN	Virtual Private Network