Antelope Consulting

Numbering for competition in Mongolia

Final draft

Antelope Consulting

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Contents

1 Introduction

1.1 Requirements

This is the report of a study for the Communications Regulatory Commission (CRC) in Mongolia funded by the World Bank. The study had the following terms of reference:

1. Design a numbering plan for telecommunications services.
   - The plan should take into account a liberalised telecommunications market with many operators providing different networks and services, in accordance with the planned netco/servco split to be implemented in Mongolia.
   - The plan should take into account both current and future telecommunications services, and should be easily adaptable to cater for the growth in such services and operators.
   - The plan should recommend the appropriate numbering systems for different services (fixed, mobile, free phone services, numbering for value-added services such as special numbers for directory services, carrier selection codes, signalling point code, telex numbering, satellite services, data etc) taking into account world-wide developments in telecommunications.
   - The plan should make it possible for customers to relate a number to the charge for calling such a number, including any varying charges for calling different geographical areas.
   - The plan should take into account the existing numbering plan and minimise changes to customers' numbers.
   - The plan should allow for number portability between network operators and/or service providers and should also be designed to accommodate new developments taking place such as ENUM protocol based services.
2. Propose interim procedures which should be followed during the transition phase. These should include how both operators should inform the public about changes to the numbering plan, the duration of the transition phase, other measures which operators should take during the transition phase (e.g. duration, if any, when both the old and the new number should be usable).
3. Propose outline procedures and schedules for the implementation of number portability for the different services.
4. Propose procedures for administering and allocating numbers to operators, including monitoring usage of numbers, types of reports, if any that operators should submit.
5. Propose a code of practice for operators in the use and allocation of numbers.
6. Review and assess options for pricing/charges for the administration/use of numbers.

In addition to these formal Terms of Reference, CRC mentioned particularly:

- Definitions of terms (for example, international prefix, national prefix, area code, subscriber number, short number, access code, signalling point code and network selection code).
- Terms and requirements for issuing number blocks to network operators.
- Evaluation based on systematic methods and international trends.
- Number portability and its applicability in Mongolia.

- ENUM standardisation and its applicability in Mongolia.
- Numbers for SMS, MMS, toll free service ('800') and premium rate service ('900').

The report is largely about numbering policy, not other policies for telecommunications development. Carrier selection and number portability are matters for competition policy, which CRC is developing in parallel with this study. The report discusses the implications for numbering of carrier selection and number portability, but it does not consider competition policy in detail.

1.2 Sources and structure of the report

The first draft report drew on information and views gathered from:

- CRC and industry participants in Mongolia, as represented at and after meetings during a visit to Mongolia by the consultant in November 2006.
- The background knowledge and research of the consultants[1].

Our understanding of the detail of the numbering situation in Mongolia during the main study period (March to April 2007) is provided in Annex A.

The first draft report was circulated and presented to CRC and industry participants in Mongolia during a further two-week visit to Mongolia by the consultant in May 2007. Following this visit, a discussion paper was produced and is provided in Annex B. CRC translated this into Mongolian and used it as the basis for a workshop held in June 2007.

This final draft report reflects all the comments and input received. After this introduction, it has the following main parts:

- Section 2 summarises the main conclusions of the report and all the recommendations
- Section 3 outlines the thinking behind these conclusions and recommendations and offers guidelines on implementing changes.
- Sections 4, 5 and 6 deal with the most difficult structural issues affecting the future E.164 numbering plan: fixed network identification codes, use of first digits, the trunk prefix and local dialling, and carrier selection codes. Some parts, especially Sections 4.2 and 5.2, are included as a record of the analysis that went into the study, but it is not essential to understand or even read them in order to follow the rest of the report.
- Sections 7, 8, 9 and 10 deal with other, less difficult, features of redesigning the numbering plan: mobile numbering, nomadic numbers, specially tariffed numbers, and short codes.
- Sections 11, 12 and 13offer guidance to CRC on numbering administration, number charging and rules for the use of numbers.
- Section 14 provides a brief overview of number portability.
- Sections 15 and 16 deal with other numbering systems.

[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.

1.3 Terminology

To help with discussions later in this report, in this section we provide definitions and descriptions of important phrases. For convenience, a reference list of all abbreviations used is provided in Annex C.

1.3.1 Numbers and codes

Figure 1 shows the structure of international phone numbers, as defined in International Telecommunication Union (ITU) recommendation E.164.

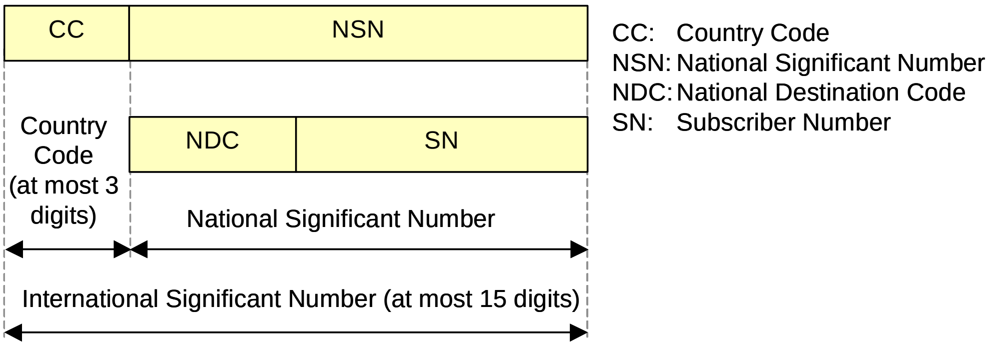

Figure 1 Structure of international phone numbers

The phone numbers defined by E.164 are not the only ones that are used. In particular, there are also short codes, which are not defined by an ITU recommendation because they usually cannot be reached from foreign countries. We refer to both phone numbers defined by E.164 and short codes as 'numbers'. In Mongolia currently most short codes begin with 1.

A geographic National Destination Code (NDC) specifies a geographic area associated with the recipient of calls, usually for routing the calls. In Mongolia currently a geographic NDC consists of a fixed network identification code (FNIC) followed by an area code. The FNIC can be 1 (MTC) or 2 (Railcom). The area code can be the Ulaanbaatar code (1), a capital region city code (21, 22 or 23), an aimag centre code (such as 372 for Darkhan) or a soum centre code (such as 3742 for Salkhit); the first two digits of an aimag centre code or a soum centre code are the aimag code. A fixed network identification code, an area code or an aimag code on its own is not a complete NDC. A geographic NDC is followed by a Subscriber Number (SN) that begins with an exchange code.

Numbers can also be of various kinds, such as the following:

- **A local number**. This is a Subscriber Number that can be preceded by a geographic NDC to produce a national number. In Mongolia currently local numbers begin with 2, 3, 4, 5, 6 or 7.
- **A national number**. This is a National Significant Number. In Mongolia currently national numbers begin with 1, 2, 5, 7, 8 or 9.
- **A geographic number**. This is a local number or an NSN that has a geographic NDC. The fixed network identification codes are used before geographic area codes to make geographic NDCs: are 1 and 2[2].

[2] Until recently, another FNIC, 5, was also in use, to denote the government network.

- **A non-geographic number**. This is an NSN that is not a geographic number. In Mongolia currently non-geographic numbers begin with 5, 7, 8 or 9[3].
- **A short code**. This is a number that usually starts with 1 and has fewer digits than most local numbers; in Mongolia, it generally has 3 or 4 digits. In contrast to the numbers defined by E.164, the termination point associated with a short code often depends on the access network from which it is dialled, so short codes cannot usually be accessed from different access networks or geographic areas, or internationally.

So, a national geographic number is an NSN that has a geographic NDC. In Mongolia currently national geographic numbers begin with 1 or 2 and are associated with fixed phones; non-geographic numbers are associated mainly with Wireless Local Loop (WLL) phones and mobile phones[4].

We use the terms 'local dialling' and 'local calls' when referring to calls dialled using local numbers; similarly, we use the terms 'national dialling' and 'national calls' when referring to calls dialled using national numbers.

Though these numbers and codes are the most important numbers in numbering regulation, they are not the only ones. In Section 16.1 we discuss others with which CRC might be concerned.

1.3.2 Dialling sequences

A dialling sequence consists of a number, possibly preceded by one or more extra codes[5]. A dialling sequence may include (among other things):

- **The national prefix**. This indicates that the number being dialled is a National Significant Number (NSN). In Mongolia currently the national prefix is 0, but it is only used for geographic calls from fixed phones. In particular, from mobile and WLL phones, NSNs are dialled without using the national prefix.
- **The international prefix**. This indicates that the number being dialled is an International Significant Number (ISN). In Mongolia currently the international prefix is 00, but it is never followed immediately by an ISN; instead it is always incorporated in a carrier selection code that is followed immediately by an ISN.
- **A carrier selection code**. A Carrier Selection Code (CSC) identifies the trunk network or service provider used for connecting the call. In Mongolia currently there are five carrier selection codes (001, 002, 003, 004 and 005); they identify network providers for outgoing international calls but not for outgoing national calls.

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[3] When the first digit of a national number is 7, the second digit is 0 and the number provides soft switch services. Though currently such services are available only in Ulaanbaatar, the number is regarded in this report as a non-geographic number, not a geographic number, because its NDC does not specify a geographic area associated with the recipient of calls.

[4] In many countries WLL phones can have geographic numbers.

[5] In this report 'dial' does not indicate the use of telephones with physical dials. Instead it refers to any way of signalling digits to the network (now, usually, by pressing keys on a telephone keypad or sending sequences of digits that have been stored in electronic memories). Typically the digits identify the recipients of voice calls or text messages.

1.3.3 Access networks and trunk networks

Figure 2 shows the distinction between access networks and trunk networks[6].

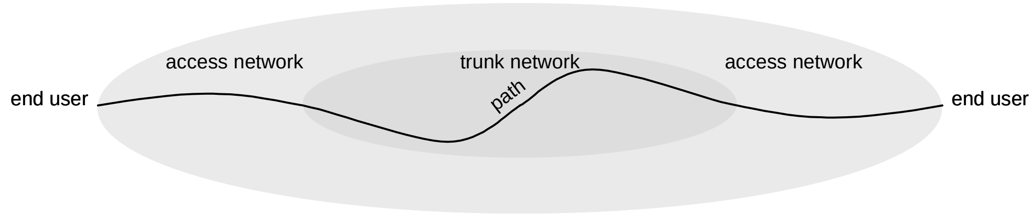

Figure 2 Access networks and trunk networks

A international call, between two users in different countries, or a national call, between two users in different parts of a country, will use the access network of the person making the call, at least one (international or national) trunk network, and the access network of the person receiving the call. A local call, between two users in the same part of a country, will use the access network of the person making the call and the access network of the person receiving the call. If these two access networks are the same, the local call will not normally need to use a trunk network.

The access networks and the trunk networks may be provided by different companies. An access-only service provider offering retail services to customers generally offers to route calls end-to-end by using a trunk network or service provider that it chooses. Carrier selection allows the customer to choose the trunk network or service provider.

1.3.4 Network providers and service providers

We distinguish between network providers and service providers: network providers have networks (and may offer wholesale services), while service providers offer retail services. In many countries network providers may also be service providers, though when they have market dominance they are usually forbidden to discriminate against other service providers that use their networks.

In Mongolia, a split is planned between netcos and servcos. The exact split is not yet defined, but we expect it to be similar to the distinction between network providers and service providers.

The split is important to, and difficult for, numbering. Phone numbers are used both by network providers (for routing calls) and by service providers (for identifying customers). There is an increasing tendency worldwide to associate numbers primarily with customers, not routes; this is shown most obviously by the development of non-geographic numbers and the introduction of number portability. In a split between netcos and servcos we would therefore expect, on balance, that servcos would be responsible for numbers. However, the routing capabilities of the netco might limit the freedom of the servco to assign numbers to customers.

[6] Sometimes trunk networks are referred to as core networks, especially in the context of Internet Protocol (IP) networks. Also, aggregation or distribution networks are sometimes distinguished from both access networks and trunk networks.

2 Summary

2.1 Features of the current plan

Numbering plans are now under pressure. There are new customers, new services and new network and service providers. All of these, in different ways, increase demand for numbers. In Mongolia, the numbering plan has already been changed in 2000 and 2004. This has helped it to withstand the pressure so far. However, the pressure is growing. Also, the need to make urgent decisions has left the plan with various features that could cause problems.

To date, the administrators have been very successful in using the numbering plan. However, these features will make the plan progressively more difficult to use. Already great care is needed when allocating national numbers with first digit 5 (for example) or devising national carrier selection codes. There are many potential conflicts between fixed network identification codes, the national prefix, carrier selection codes and short codes, and with ITU recommendation E.164.

Figure 3 compares the dialling sequences from fixed phones in Ulaanbaatar (or elsewhere, except mainly for the lengths of numbers) with the dialling sequences from WLL phones or mobile phones. Figure 3 shows, for the first and second digits of the dialling sequences, the kinds of numbers being dialled and (in brackets) the lengths of the dialling sequences. The kinds of numbers used only from the fixed phones in Ulaanbaatar have single underlines. The kinds of numbers used only from the WLL phones and mobile phones have double underlines. The kinds of numbers used from both the fixed phones in Ulaanbaatar and the WLL phones and mobile phones have no underlines.

	0	1	2	3	4	5	6	7	8	9
0	International prefix (11-18)	National prefix and MTC NIC (9-11)	National prefix and Railcom NIC (8-11)							
1	Short codes (3)	Short codes (4-5) MTC NIC and Ulaanbaatar code (8)	Short codes (3) MTC NIC and capital region code (7-8)	Short codes (3) MTC NIC and central region code (9-10)	Short codes (3) MTC NIC and western region code (9-10)	Short codes (3) MTC NIC and eastern region code (9-10)	Short codes (4)		Short codes (4-5)	Short codes (4)
2		Short codes (3) Railcom NIC and Ulaanbaatar code (8)	Short codes (3) Railcom NIC and capital region code (7-9)	Railcom local numbers (6) Railcom NIC and central region code (8-9)	Railcom local numbers (6)	Railcom local numbers (6) Railcom NIC and eastern region code (11)	Government local numbers (6)		Civil Aviation Authority local numbers (6)	
3	MTC local numbers (6)	MTC local numbers (6)	MTC local numbers (6)	MTC local numbers (6)	MTC local numbers (6)	MTC local numbers (6)	MTC local numbers (6)	MTC local numbers (6)		
4						MTC local numbers (6)	MTC local numbers (6)		MTC local numbers (6)	MTC local numbers (6)[7]
5	MTC WLL numbers (8)		Reserved for Government WLL numbers (8)	Cityfone WLL numbers (8)		Mobicom WLL numbers (8)	Skytel WLL numbers (8)		Popularcom WLL numbers (8)	
6				MTC local numbers (6)					MTC local numbers (6)	
7	MTC soft switch numbers (8)									
8		Incomnet VSAT numbers (6)							Unitel mobile numbers (8)	
9		Skytel mobile numbers (8)	Government WLL numbers (8)			Mobicom mobile numbers (8)	Skytel mobile numbers (8)		G-Mobile mobile numbers (8)	Mobicom mobile numbers (8)

Figure 3 Current dialling sequences from phones in Ulaanbaatar

Key to Figure 3:

The row identifies the first digit and the column identifies the second digit.

(Number in brackets): total number of digits dialled in sequences starting this way.

No underline: from all phones in Ulaanbaatar.

Single underline: only from fixed phones[8] in Ulaanbaatar.

Double underlines: only from WLL and mobile phones.

[7] These numbers were recently moved to start with 49 instead of 71, 72, 73 and 76.

[8] The short codes shown are those diallable from MTC fixed phones.

Figure 3 illustrates some features of the top level structure of the numbering plan that might confuse users or hinder the introduction of competition. For instance:

- Until recently, one private network (for the government) had its own network identification code, though it has a completely different status from the public networks of MTC and Railcom[9]. Fixed network identification codes are discussed in Section 4.
- Networks for other large organisations could need two sets of numbers (one using the MTC network identification code and one using the Railcom network identification code). Fixed network identification codes are discussed in Section 4.
- Only 20% of the allocated pairs of first two digits are used in the same way on fixed phones as on mobile phones, because of the role of the national prefix. Moving to the same dialling sequences from different kinds of phones is discussed in Section 5.
- Some national geographic numbers have the same first digit as some non-geographic numbers. In fact, fixed line customers where Railcom has local numbers starting with 5 may not be able to call WLL numbers starting with 5. Giving first digits meanings that are easier for users to understand is discussed in Section 5.
- There may not be enough carrier selection codes. Carrier selection codes are discussed in Section 6.
- One private network (for the government) has its own non-geographic NDC with a capacity of 1 million numbers for WLL phones, though in 2006 it had fewer than 1,000 WLL phones. This non-geographic NDC uses the first digit 9. The first digit 9 is otherwise intended for mobile phones, which have different tariffs, while the first digit 5 intended for WLL phones and could be appropriate to all nomadic phones. Nomadic numbers are discussed in Section 8.
- Soft switch services are allocated numbers outside the normal geographic ranges, though they are not available throughout the country. In fact they could be made available wherever a suitable IP network is available, so they are essentially nomadic. Nomadic numbers are discussed in Section 8
- The relation between NDCs and tariffs is not entirely clear, especially for NDCs that have first digit 5, 7, 8 or 9. Also, freephone and premium rate services are not being provided in the NDCs that are used for them in many other countries. Specially tariffed numbers are discussed in Section 9.
- On fixed phones, short codes (starting with 2, for prepaid services) can have the same first digit as local numbers. Short codes are discussed in Section 10.
- On mobile phones, short codes can have the same first few digits as national numbers. Short codes are discussed in Section 10.
- The utilisation of allocated number blocks is low: many more numbers have already been allocated to fixed, WLL and mobile networks than they can use[10]. The allocation of numbers is discussed in Section 11

[9] In fact there are also numbers for government ministries that were not on the government network. For example, the Ministry of Roads, Transport and Tourism uses some Ulaanbaatar numbers with 1131, and did not have 5126, as their first four digits.

[10] The utilisations can be calculated in various ways. If the blocks were defined by the NDCs themselves and contained 8-digit numbers only, there would be 10 million numbers allocated for fixed phones, 6 million numbers for WLL phones and 6 million numbers for mobile phones.

There are other features of the numbering plan that might confuse users and hinder the introduction of competition. For instance:

- Mobile (and WLL) numbers incorporate aimag codes in a way that can cause difficulties. Mobile numbers are discussed in Section 7.

This report deals with other problems of number management, besides those related to the numbering plan. These include:

- Implementation of number changes, discussed in Section 3.
- Allocation of numbers, discussed in Section 11.
- Charging for numbers, discussed in Section 12.
- Conditions on the use of numbers, discussed in Section 13.
- Number portability, discussed in Section 14.
- ENUM, discussed in Section 15.
- Other classes of number, such as signalling point codes and telex numbers (and indeed IP addresses), discussed in Section 16.

2.2 The main recommendations

The main recommendations of this report relate to three separate time periods, as illustrated in Figure 4:

- **Urgently**, to clarify the future use of each first dialled digit (so as to avoid confusion between local and non-geographic numbers), and soon, to change non-conforming numbering to match this clarification.
- **As soon as convenient**, to merge the two remaining separate Fixed Network Identification Codes (1 and 2) into the single code 1 which will mean ‘geographic numbering’.
- **After due consultation and consideration**, and possibly in the light of developments over the next few years, to decide on a long-term future for the numbering plan. This report provides and discusses several long-term options (Options A, B, C, D and E).

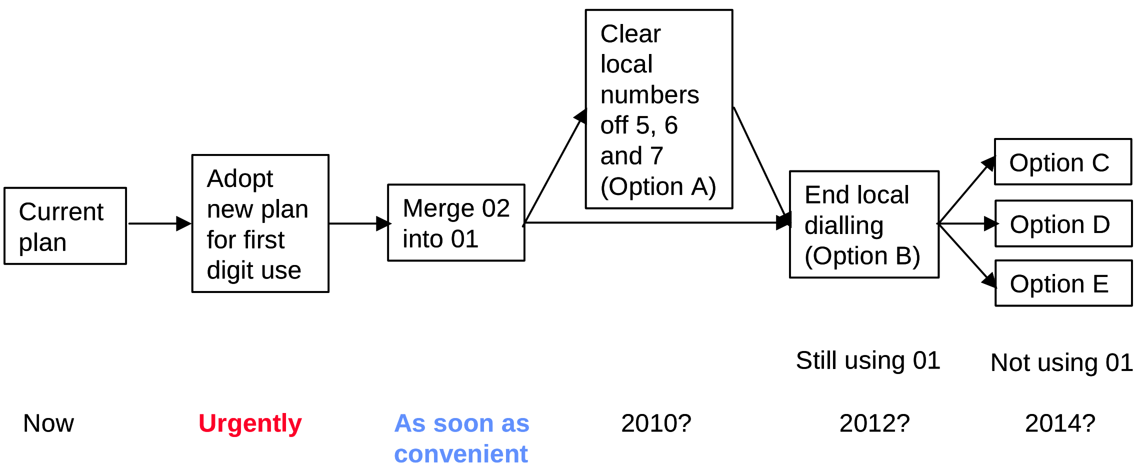

Figure 4 Timing for recommendations

Key features of the long term options (Options A, B, C, D and E) are summarised in Figure 5 below, and discussed in detail in Section 5. We find there that the options are overall of fairly balanced merits. The choice among them depends on the trade-off between short term costs of change and long term requirements for capacity and ease of use.

Option	Local dialling	Trunk prefix 0	Comment
A	Continues on 2, 3 and 4	Still used for national calls from fixed phones to fixed phones	Can still move to any other option
B	None - full national dialling only	Still used for calls from fixed phones to fixed phones	Can still move to Options C, D or E
C	None - full national dialling only	No longer used	Geographic numbers and short codes share 1
D	None - full national dialling only	No longer used	First digit of geographic numbers changed
E	None - full national dialling only	No longer used	First digit of short codes changed

Figure 5 Long term options for the numbering plan

Figure 6 shows a possible top level structure of the numbering plan in the medium term[11] as proposed in this report. The blank cells are initially free but could be filled with numbers allocated according to the same principles. The proposal is designed to simplify and unify the numbering plan so as to avoid most of the problematic features identified above. It involves:

- For clarity of meaning, identifying number ranges which will be used in future for national non-geographic numbers, and avoiding their use in future for local geographic numbers. We discuss this in detail in Section 5.4.
- In keeping with international trends, preparing for the future possibility of eliminating local dialling, so that national numbers are always dialled. This can be done sooner or later, as discussed in Section 5.3.
- For competitive and other reasons, replacing the two fixed network identification codes by one digit meaning "geographic numbers", as described in Section 4.2.2. In Figure 6 this one digit is 1, but long term it could change to another values, such as 6. We discuss long term developments in Section 5.2 and Section 5.3.
- Moving towards unifying national dialling sequences from all types of phone. Long term we expect use of the national prefix 0 to decline, and we provide options for eliminating it completely.
- Using the standard international prefix 00 as the default if international carrier preselection is available, as described in Section 6.4.
- Reserving the dialling sequences 0XY (where X is not 0 or 1) for carrier selection codes, as discussed in Section 6.4.
- Devoting the first digit 1 to a rationalized use of short codes, as described in 10.4.

[11] That is, after implementation of the first two recommendations but before any long-term option has been implemented.

	0	1	2	3	4	5	6	7	8	9
0	Default inter-national prefix (10-17)	Geographic numbers (8-11)	Reserved for carrier selection codes	Reserved for carrier selection codes	Reserved for carrier selection codes	Reserved for carrier selection codes	Reserved for carrier selection codes	Reserved for carrier selection codes	Reserved for carrier selection codes	Reserved for carrier selection codes
1	Short codes (3-5)	Short codes (3-5) Ulaanbaatar code (8)	Short codes (3-5) Capital region code (7-9)	Short codes (3-5) Central region code (9-10)	Short codes (3-5) Western region code (9-10)	Short codes (3-5) Eastern region code (9-10)	Short codes (3-5)	Short codes (3-5)	Short codes (3-5)	Short codes (3-5)
2		Short codes (3)	Short codes (3)							
3										
4										
5	MTC WLL numbers (8)		Government WLL numbers (8)	Cityfone WLL numbers (8)		Mobicom WLL numbers (8)	Skytel WLL numbers (8)		Popularcom WLL numbers (8)	
6										
7	MTC soft switch numbers (8)	Incomnet VSAT numbers (8)[12]								
8									Unitel mobile numbers (8)	
9		Skytel mobile numbers (8)				Mobicom mobile numbers (8)	Skytel mobile numbers (8)		G-Mobile mobile numbers (8)	Mobicom mobile numbers (8)

Figure 6 Proposed dialling sequences

Key to Figure 6:

The row identifies the first digit and the column identifies the second digit.

(Number in brackets): total number of digits dialled in sequences starting this way.

No underline: from all phones

Single underline: only from fixed phones

Double underlines: only from WLL and mobile phones.

Shaded cells are also used for the time being for local subscriber numbers (geographic numbers) somewhere in Mongolia (maybe in Ulaanbaatar, in aimags or both)[13]. These can only be dialled from fixed phones within the same geographic NDC.

[12] This suggestion is made on the unverified assumptions that calls to Incomnet cost much the same as soft switch calls (which at present do cost much the same as ordinary fixed network calls), and that Incomnet is able to implement the change without difficulty.

[13] Local numbers starting with 5 and 7 can also exist currently but will be changed before the medium term.

Figure 7 illustrates how the top level structure of the numbering plan might evolve after the end of local dialling[14]. In it national numbers and short codes are used to provide information about geography and tariffs as described in Section 9.4 and Section 10.4. In general:

- Different geographic regions are associated with the same first digit (1) but different second digits (1, 2, 3, 4, 5) in geographic numbers, which begin with 11, 12, 13, 14 and 15.
- Different tariff ceilings are associated with different first digits and, in some cases, the choice between 0 and other second digits (so different tariff ceilings are associated with 80, 90 and 95, but the same tariff ceiling is associated with 95 and 96).

	Meaning	**Geographic numbers**
0	International prefix and carrier selection codes	
1	Short codes and fixed phone numbers, and services at similar tariffs	Yes
2	Reserved	
3	Reserved	
4	Reserved	
5	WLL numbers, and services at similar tariffs	No
6	Reserved	
7	Soft switch numbers, and services at similar tariffs	No
8	Mobile numbers, and freephone on 80	No
9	Mobile numbers, and premium rate services on 90	No

Figure 7 Long term possible meaning for first dialled digit

Later in this report we explain why we are making these recommendations (and many other detailed recommendations, too). Our general method is to identify a comprehensive set of options for dealing with each problematic feature of the numbering plan and to evaluate the options against criteria like those listed in Section 3.1.

2.3 The full recommendations

For convenience we list here the recommendations that are also provided at the ends of later sections of this report.

Fixed network identification codes

1. Replacing the two current Fixed Network Identification Codes (1 and 2) by a single digit meaning “geographic numbering”.
2. Choosing this single digit to be 1 in the short term.
3. Reserving 6 or 4 for a long term change.
4. Deciding on whether to make this long term change, and on what form the change should take, in the light of demand for numbers over the next few years.

[14] This Figure follows long term Option C.

The national prefix and use of first digits

1. Making no change in the use of the national prefix 0 in the short term, so it continues to be required only for calls to geographic numbers from fixed phones.
2. Adopting rules to ensure that first digits of national numbers have easily recognised and consistent meanings.
3. Restricting local numbers to start only with 2, 3 or 4 (Option A) in the medium term.
4. Consulting the industry and consumer groups about whether to adopt one of the Options B, C, D and E (or some other variant), and about which option should be adopted.
5. If a consensus is reached after the consultation, adopting the consensus as national policy and working towards its implementation.
6. If no consensus is reached after the consultation, reviewing the position every two to three years and deciding on an option when any type of numbering is becoming scarce.

Carrier selection codes

1. Introducing a range of new carrier selection codes, such as 06x.
2. Not issuing any new carrier selection codes of the form 00x, and issuing existing carriers with new codes of the same form issued to new carriers.
3. Using these new codes followed by 00 for international carrier selection, and the same codes followed by 0 (if retained as the national prefix) for national carrier selection.
4. Over a period, phasing out the use of the current international carrier selection prefixes (001, 002, 003, 004 and 005), either by agreeing a sunset date for these old codes with the industry once the new codes are in operation or by charging much more for the old codes than for the new ones.
5. When 001, 002, 003, 004 and 005 have been withdrawn, allowing use of 00 as the default international prefix (with the carrier to be chosen, where possible, by carrier preselection, and otherwise by the access network service provider).
6. Clarifying (as a matter of competition policy) which class of access service providers must provide carrier selection facilities for which class of carriers, and how and on what conditions access service providers may choose default carriers (such as the meaning of + from mobile phones).

Mobile numbers

1. If possible, removing the relation between mobile tariffs and aimag codes, and providing any “local discount” tariffs on another basis, such as using ‘friends and family’ or ‘home zone’ arrangements.
2. If tariff policy does not permit the first option straight away, considering as a step towards it an arrangement whereby numbers relate to regions rather than to aimags, and “local discount” tariffs (at a level between current national and aimag tariffs) are offered for the region rather than just for the aimag. Numbers would be available throughout the region to relieve any shortages in aimags.
3. If the first recommendation is not possible and the second is not agreed, identifying ‘extra aimag codes’ for each aimag where mobile numbers are likely to reach exhaustion and requiring that all of the mobile service providers use them when they need more numbers.
4. Requiring that existing allocations of numbers are highly used before new allocations are made.

5. Requiring that for each mobile NDC one particular third digit of the numbers remain unused, to let the numbers be easily lengthened in the future, if necessary.

Nomadic numbers

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.
   - Other services with strong claims to geographic numbers can still have enough numbers.
   - All interconnected networks can route calls to the numbers.
2. Allowing all services to have non-geographic numbers provided that:
   - All calls to the numbers have call charges at or below tariff ceilings set by CRC for the NDCs of the numbers.

Specially tariffed numbers

1. Consulting the industry and consumer groups about non-geographic numbering classes, dealing with, in particular:
   - Which kinds of information should be embedded in non-geographic numbers.
   - How many tariff ceilings for non-geographic numbers would be needed, and how many numbers would be needed for each tariff ceiling.
   - Which (if any) current numbers should be moved to fit the NDCs for specially tariffed numbers
2. Introducing consumer protection arrangements for specially tariffed services, bearing in mind the possibilities for barring messages, introducing messages about tariffs, and associating tariff or content information with number ranges.
3. Treating the government network no differently from other private networks, without special network identification codes or NDCs.
4. Dedicating 80xx xxxx to freephone services and 90xx xxxx ranges to premium rate services. Some shorter ranges, for example of 6 digits, may be considered for services such as SMS and MMS that may be used on the move.
5. Reserving NDCs 20, 30, 40, and 60 for information services at special tariffs or other future applications requiring distinctive numbering.

Short codes

1. Requesting from all service providers figures for the utilisation of each short code.
2. Imposing strict requirements (such as essential relevance to safety, minimum levels of utilisation, uses related to telecommunications or uses unsuitable for just national numbers) to justify obtaining or retaining short codes.
3. Raising charges for short codes, at least when service providers want more than one.
4. Requiring that certain short codes have the same interpretations for all networks and locations and that the provision of these short codes be mandatory in some cases (such

as for emergency assistance services) and optional in other cases (such as for directory enquiry services).

5. Minimising conflict between short codes and geographic numbers if long term Option C is to remain open.
6. Reserving a range of short codes for use if there are ever to be competing directory enquiry service providers.
7. Requiring that all numbers conform with applicable regulations about tariff ceilings and access from other networks and locations.
8. Consulting the industry and consumer groups about the short code structure, dealing with, in particular:
   - Whether having at most one 1xx code per service provider would be feasible.
   - Which other short codes should be used for which purposes in a new structure for short codes.
   - Which short codes should be in a set of common service codes for parallel use by all fixed and mobile access service providers.
   - What other harmonisation between short codes on fixed and mobile phones (including those using * and #) would be feasible.
9. Monitoring the development of USSD short codes to determine whether they should be subject to the same regulation as SMS and MMS short codes.
10. Encouraging or requiring migration of premium rate services from short codes to full length national numbers starting with 90. For example, the current code 1923 might migrate to 9000 1923.
11. Encouraging or requiring migration of internet access codes from short codes to appropriately tariffed full length national numbers.
12. Opening special ranges of appropriately tariffed national numbers (possibly at less than full national number length) for value-added SMS and MMS. These could, for example, be 907 xxx, 908 xxx, 909 xxx (with 7, 8 and 9 as tariff band indicators).

Allocation of numbers

1. Issuing explicit rules about the utilisations expected in existing allocations of numbers blocks before new allocations will be made.
2. Withdrawing portions of existing allocations of numbers where the service providers have not used them and do not have good expectations of using them soon.
3. Identifying potentially memorable numbers, taking into account the cultural factors specific to Mongolia.
4. Introducing demonstrably fair allocation processes for potentially memorable numbers.
5. Reserving for each NDC the numbers that have a particular third digit (for 2-digit NDCs), which is chosen as consistently as possible for all NDCs, to allow for possible future extensions to the numbers for that NDC.
6. Reviewing trends in demands for numbers annually.
7. Exploring with the industry which organisations should be eligible for primary allocations and which organisations should be eligible for secondary allocations.
8. Imposing requirements on allocations that apply to secondary allocations as well as to primary allocations.

Charging for numbers

1. Designing charges according to clear principles.
2. Publishing an explanation of the principles along with the charges.
3. Avoiding auctions of, and trading in, individual numbers in NDCs that do not offer service provider number portability.
4. Using number charges to support whatever decision is made on the future of carrier selection codes.

Conditions on the use of numbers

1. Codifying the obligations and rights, by extending the *Procedure on the Provision of Numbering to the Telecommunications Network* or otherwise.

Number portability

1. Discouraging the use of NDCs for branding service providers pending the possible introduction of service provider number portability.
2. Encouraging the use of just the first digit 9 to mean 'mobile phones' (so the mobile numbers currently starting with 8 would need to be changed to start with 9).
3. Introducing, in consultation with service providers, processes for the migration of users between service providers, with the correct and speedy transfer of information for service provider number portability.
4. Attending to the other factors that contribute to the effectiveness of service provider number portability when introducing it.

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, in a few years' time, 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 number ranges just for enum users.
4. Introducing, in consultation with service providers, processes for the migration of users between service providers, with the correct and speedy transfer of information for enum.

Other classes of numbering

1. Agreeing with the industry which ranges of national SPCs should be allocated by network providers under delegation from CRC.
2. Stating to the industry that potential problems with existing ways of allocating telephony codes and internet codes should be reported to CRC as soon as they arise.
3. Reviewing trends in demands for codes annually.

3 Designing changes in numbering plans

3.1 Criteria for comparing options

To decide which is the best way to develop the numbering plan, we test different options against a fixed set of criteria.

Basic requirements of all numbering plans include:

1. **Adequate supply of numbers and codes**. Number changes need to provide enough numbers and codes of all known kinds, for both the short term and the long term. They should also provide flexible empty numbering space for unknown future uses, and be easily expandable to meet even larger future demands.
2. **Fairness to all market participants**. New market entrants must be able to obtain enough numbers and codes that are as desirable to users, and as efficiently implemented, as the numbers and codes allocated to existing service providers.

When a numbering plan is being reviewed, there is an opportunity to improve its structure. Well-designed numbering plans usually have characteristics that include:

3. **Clear purpose**. The numbers and codes need to be defined well, so that there is no doubt about how they should be used and what they mean; for example, fixed network identification codes need to be distinguished clearly from carrier selection codes.
4. **Conformity with international best practice**. Both widespread practice in other countries and ITU recommendation E.164 affect what is easy for users and efficiently implemented. Incorrect dialling of incoming international calls and of national or local calls by foreign visitors should be avoided.
5. **Consistent dialling**. It is easier for users if a call can be made in the same way from different phones - for example, from fixed and mobile phones. In this report we assess consistency by estimating the proportions of numbers and calls (or, failing that, call minutes) needing different dialling sequences from fixed and mobile (and WLL) phones.
6. **Short dialling sequences**. Shorter numbers are easier to remember and dial correctly.
7. **Uniform dialling patterns**. Uniform patterns of numbers (for example, having the same length and the same layout) are easier to remember and dial correctly. However, making dialling sequences uniform may conflict with making them short.

When considering a major change to the numbering plan, another important criterion for assessing the change is:

8. **Ease of implementing the change**. The ease of implementing number changes depends on whether they can be completed in one step and whether they permit parallel running of the old and new schemes. Parallel running allows business systems, customer premises equipment and customer thought patterns to adapt over a period.

One way of assessing ease of implementing the change is to estimate its size:

9. **Size of the change**. In this report we assess this by considering the proportions of numbers and calls (or, failing that, call minutes) needing changed dialling sequences.

In the rest of this report, and especially in Sections 4, 5 and 6, we use some or all of these nine criteria to compare the merits of different options for Mongolia.

3.2 Good practice in implementing changes

CRC has asked for advice in how to implement the new numbering plan. Naturally, detailed advice depends on what new plan is to be implemented. Here we provide guidance based on generally accepted good practice in implementing numbering plan changes.

After a numbering plan has been reviewed and the change has been agreed, there may still need to be decisions about practical details such as whether the change should be made all at once ("big bang") or in stages. A "big bang" may be simpler to publicise and understand, at least where national publicity media like television are used. However, staged changes have flatter resource profiles and imply less commitment to precise dates; they may also be easier for the public to assimilate when the changes are complex.

The media that will be used to inform customers about change are a vital consideration. These may include national broadcasts (television and radio), newspapers, posters, phone bills and phone messages voice and SMS). In Sweden, information about the national emergency number has recently been printed on milk cartons. Where national media are used, and can be expected to reach a high proportion of customers, it is often most effective to communicate a single message to everybody. Group messaging can selectively communicate different messages. In the special circumstances of Mongolia, with some customers living in very remote areas, it may well be necessary to supplement any national campaigns with targeted group messaging to be sure of reaching everyone.

The role of the regulator in implementation is normally confined to top-level oversight to ensure that everything is going to plan, and where appropriate helping with public relations to justify and explain the change. For this purpose CRC could devise a checklist of implementation requirements, including the items mentioned below. The regulator does not normally meet any substantial costs of change, which are met where they fall (by each company separately), unless the industry agrees otherwise, for example, by carrying out jointly-funded publicity campaigns.

Service providers must:

- Modify exchanges of different types. This is best done gradually, to avoid unacceptable risk of network failure. The modifications include ones to CLI functions as well as to number recognition, charging and routing functions[15].
- Implement recorded announcements for incorrectly dialled calls, giving information on how to dial correctly. Ideally these announcements should remain in place until misdialled calls have fallen to very low levels, which could take several months from the change date.
- Modify all operational support systems that hold phone numbers, including directories and customer service systems.
- Check that service providers abroad modify international exchanges correctly[16].

Collectively CRC and the service providers should:

- Get political acceptance of the change.

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[15] For an overview of the BT handling of changes in the UK see *National Code and Number change – Technical Solutions for BT's Network*, by Beatrice Osborn and others, **The Journal of the Communications Network** volume 1 part 1 April 2002, pages 107-113, at http://www.ibte.org/recent/tcn011bo.pdf.

[16] For ways of communicating numbering plan changes around the world see *Presentation of national numbering plans*, ITU-T Recommendation E.129 (ITU, September 2002) at http://www.itu.int/rec/recommendation.asp?type=items&lang=e&parent=T-REC-E.129-200209-I.

- Provide advance publicity of the change both to people with phone numbers (who may need to change stationery, signs, vehicles and so on) and those who call them (who may need to change their records and personal habits). Publicity must be far enough but not too far ahead; in some countries the most demanding users are diary publishers, who may need information two years ahead.
- Plan a period of parallel running, during which both the old schemes and the new schemes would be effective, to let business systems, customer premises equipment and customer thought patterns adapt.
- Support changes to customer premises equipment like payphones and automatic alarms.

CRC and the service providers must work together on the administrative and technical arrangements for changes to the numbering plan. The CRC Numbering Working Group that has already been set up with industry representatives is the obvious body to take these matters forward.

4 Fixed network identification codes

4.1 The current position in Mongolia

Currently the fixed network identification codes (1 and 2) are used only for the fixed networks of MTC and Railcom[17]. This kind of code has various disadvantages. In particular:

- They become confusing, if carrier selection for national long distance service providers is introduced[18].
- They become meaningless, if service provider number portability is introduced.
- They become anti-competitive, if a customer connected to two public networks is to use the same number on each connection[19].
- They can be used to discourage people from taking service from alternative service providers, because they can have an image of cheapness and inferiority, unlike well-established numbers.
- They are unnecessary, because they duplicate information that is available in later digits of dialling sequences, where the exchange code identifies the access network.
- They create confusion among foreign correspondents about what is the correct country code for Mongolia (+976, +9761 or +9762).
- They are inconsistent with almost universal practice in other countries[20].

These disadvantages suggest that fixed network identification codes should be eliminated. Eliminating them involves either removing them or replacing them. For reasons explained below, we recommend replacing them by a single digit meaning "geographic numbers". The obvious choice for this digit short term is 1, since this minimises immediate change. As already mentioned, the best choice long term depends on other decisions about the use of 0 and local dialling. We discuss this further in Section 5.3.

However, if fixed network identification codes are eliminated, there must be substitutes for their current roles in national and international routing. Substitutes are available as follows:

- We believe that there should be no problem for **national routing**. Most national routing in Mongolia is done by analysing the first three digits of national geographic numbers, except

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[17] Until recently a third code, 5, was used for the government, and there are still some references to this practice in current documentation. The government network was different from the MTC and Railcom networks, because it was not a public network: it did not have customers who can choose between it and competing networks.

[18] In network identification, the recipient of a call determines the access network or service provider used to receive the call. In carrier selection, the caller determines the trunk network or service provider used to connect the call. See *Alternatives for carrier selection and network identification*, ITU recommendation E.164 supplement 1 (ITU, March 1998) at http://www.itu.int/rec/T-REC-E.164-199803-I!Sup1.

[19] Large companies usually want to connect their networks to at least two public networks, to increase network availability, but they require that the same numbers can be used for incoming calls irrespective of the connected public networks used by the calls. If they must include network identification codes in their numbers they are unable to use the same numbers. Their callers will be puzzled and duplicate numbers will be wastefully provided on all of the connected public networks.

[20] The only other countries that we know have fixed network identification codes are Madagascar and Malawi.

for the national prefix (0) if it is present, or the first four digits of non-geographic numbers. The service providers say that five or six digits could be analysed without causing difficulty. The exchange codes of soum centres occur as the sixth digit after the national prefix (if present). So if fixed network identification codes are eliminated, national routing is still feasible, provided that deeper digit analysis is introduced.

- In principle, **routing of incoming international calls** could be more difficult, if these calls were to be routed directly to the Railcom gateway when the final destination is on the Railcom network. Formally, ITU recommendation E.164 requires that, unless domestic national service providers make suitable bilateral arrangements with foreign international service providers, incoming calls can be routed to international gateways determined by at most the first four digits dialled after 976 (for Mongolia)[21]. However, we understand that in practice this is not a problem, as the international gateway in Mongolia is chosen by the remote carrier, and all Mongolian international gateways provide onward routing within Mongolia to the final destination network[22].

4.2 Options for Mongolia

Figure 8 summarises the possible treatments of fixed network identification codes (FNICs) that are described at greater length later in this section and evaluates the treatments informally in terms of some of the desirable features of number changes explained in Section 3.

Option	**Adequate supply of numbers and codes**	**Fair to all market participants**	**Clear purposes**	**Conforms with inter-national best practice**	**Short dialling sequences**	**Uniform dialling sequences**	**Ease of implement-ing the change**	**Proportions[23] needing changed dialling sequences**
3.2.1 Retaining FNICs	Bad	Bad	Bad	Bad	Satisfactory	Bad	Excellent	0%
3.2.2 Replacing FNICs	Excellent	Good	Good	Good	Satisfactory	Good	Good	2%[24]
3.2.3 Removing FNICs	Satisfactory	Good	Good	Good	Good	Good	Bad	25%-30%

Figure 8 Possible treatments of fixed network identification codes

[21] See *The international public telecommunication numbering plan*, ITU Recommendation E.164 (ITU, February 2005) at http://www.itu.int/rec/T-REC-E.164-200502-P.

[22] Such onward routing could also be a function of the softswitch that we understand currently handles all inbound international calls.

[23] Proportions of assigned numbers or of calls (calculated on various reasonable assumptions).

[24] This assumes that the fixed network identification codes are replaced by 1 and that 30% of the call minutes for calls from WLL and mobile phones are to fixed phones.

4.2.1 Retaining fixed network identification codes

The advantage of this option is that it requires no changes in dialling sequences or in routing arrangements. However, it still has all the disadvantages of fixed network identification codes that are outlined in Section 4.1. We regard these disadvantages, especially the restriction of competition, as so serious that we cannot recommend this option.

4.2.2 Replacing fixed network identification codes

This option requires changes in some dialling sequences. For example, **2** 372 41234 would change to **1** 372 41234[25]. It requires work in exchanges to analyse numbers more deeply for routing purposes, and in some cases routing changes may be necessary in keeping with exchange capabilities[26].

However, because it avoids the disadvantages of fixed network identification codes, and also (unlike the next option) provides plenty of capacity for all future uses, this is the option that we recommend.

The simplest approach, which we believe is suitable for Mongolia, is that national geographic numbers should all begin with the same digit[27]. We discuss the choice of this digit in Section 4.3.

4.2.3 Removing fixed network identification codes

In this option, fixed network identification codes would no longer be used at all. National geographic numbers would begin with 1, 2, 3, 4, and 5.

Like the previous option, this avoids the disadvantages of fixed network identification codes. It has two advantages over the previous option:

- Geographic numbers would be one digit shorter.
- No change would be needed in arrangements for incoming international calls.

However, it also has serious disadvantages compared with the previous option:

- Unless all WLL numbers were changed, there would be confusion over the mixed meaning of the first digit 5 (which would mean both WLL numbers and the eastern geographic region)
- Geographic numbering would occupy half the total capacity of the numbering plan, which is disproportionate to its importance in the sector and could mean a shortage of numbering capacity for other uses
- The change would be more difficult to manage: the message to users would be more complicated and trapping misdialled calls might involve exchanges examining the lengths of numbers.

For these reasons we do not recommend this option.

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[25] Or, long term, to another value such as 6.

[26] Railcom is concerned that some of its small exchanges may be unable to carry out the required number analysis. If this proves to be the case, then the traffic in question will need to be routed via a higher-level exchange in the switching hierarchy (as already appears to be the case for a high proportion of the Railcom routings).

[27] Geographic numbers could use two or more different digits, but we see no real advantage in this. Using a single digit provides ample capacity for both geographic and non-geographic numbers and provides most future flexibility.

4.3 Choice of digit to replace fixed network identification codes

The choice of digit to replace fixed network identification codes (to mean "geographic numbering" in the restructured plan) is not as simple as it may seem.

The obvious short-term candidate is 1, as this is the digit most used at present for calls to fixed network phones and it would mean least change in dialling patterns. Unfortunately, however, choosing 1 makes it hard to eventually drop the use of 0 completely, as there would then be a conflict between national geographic numbers and short codes on the digit 1. (Our arguments here assume that it is desirable to tell which kind of number is being dialled from its first few digits (preferably just the first digit). Even if networks can tell which numbers are which by testing their lengths (for example, that 142 234 is a mobile short code while 142 23456 is a geographic number), this can be confusing for human beings.) Following the initial move from two FNICs (2 and 1) to just 1, another change in some years' time from 1 to another digit should be relatively straightforward, because this is a simple substitution in both dialling patterns and routing.

We do not recommend considering 0, 2, 3, 5, 7, 8 or 9 as this digit for the following reasons:

- 0 could be confused with the national or international prefix, and is against best international practice
- Unless local dialling is abolished long before this change is made, 2 and 3 could both lead to significant misdialling problems during the changeover period (as most local numbers in Ulaanbaatar start with 3 and most local numbers in aimags start with 2)
- 5, 7, 8 and 9 all have meanings already that it seems sensible to keep or adapt in the long-term plan (5 has recently been introduced for WLL numbers, 7 is soft switch numbers and 8 and 9 are mobile numbers).

We recommend using 1 as this digit to start with, but keeping open the future possibility of moving geographic numbers to another range, which would permit dropping the national prefix 0 completely without creating a conflict between geographic numbers and short codes. This means reserving a digit for the purpose. The remaining candidates for this are 4 and 6, and on balance we tend to favour 6:

- 4 would be consistent with a more logical long-term structure for the plan (with services that are more expensive to call numbered on higher digits). However it is not a suitable choice if local dialling continues, because of conflicts with local numbering in both Ulaanbaatar and aimags.
- 6 is consistent with continuing local dialling in aimags, and could be made consistent with continuing local dialling in Ulaanbaatar if just the local numbers starting in 63 (one block of 10,000 capacity) were changed. It is less clearly consistent with a logical long-term structure for the numbering plan. We still suggest it, because a change to 6 would be relatively easy to implement.

4.4 Recommendations for Mongolia

We recommend:

1. Replacing the two current Fixed Network Identification Codes (1 and 2) by a single digit meaning "geographic numbering".
2. Choosing this single digit to be 1 in the short term.
3. Reserving 6 or 4 for a long term change.
4. Deciding on whether to make this long term change, and on what form the change should take, in the light of demand for numbers over the next few years.

5 The national prefix and use of first digits

5.1 The current position in Mongolia

Currently the national prefix (0) is used as the first dialled digit only in dialling national geographic numbers for calls from fixed phones to fixed phones. We estimate that these calls occupy 5% of the call minutes in Mongolia, so the first dialled digit is not 0 for more than 95% of calls[28]. Nonetheless, the current *Mongolian Standard* for numbering indicates that the first dialled digit should be 0 in all calls to national geographic numbers and non-geographic numbers.

This current usage of the national prefix has various disadvantages. In particular:

(a) It is counter to fixed-mobile convergence, because geographic numbers have two dialling sequences (for dialling from fixed phones and for dialling from WLL phones and mobile phones).

(b) Because non-geographic numbers share the same set of first digits as local numbers and fixed phone short codes, it risks creating shortages of numbers.

(c) It is inconsistent with almost universal practice in other countries and with ITU recommendation E.164, so it may lead to incorrect dialling of incoming international calls and of national or local calls by foreign visitors.

These disadvantages suggest that the usage of the national prefix should be changed. Changing it involves either removing the national prefix or extending its usage.

Either of these can be consistent with widespread practice in other countries and with ITU recommendation E.164: though 0 is the national prefix preferred in the ITU recommendation, there does not need to be a national prefix to satisfy the ITU recommendation.

Figure 9 shows the options for use of the national prefix that we evaluate in this report.

[28] The main figures available to us date from 2003. At that time, MTC revenues from aimags were derived 32% from national long distance calls (both subscriber-dialled and operator-connected), 14% from local calls, 40% from calls to mobile phones, 4% from international long distance calls (both subscriber-dialled and operator-connected) and 10% from rentals; also, MTC tariffs for national long distance calls were perhaps ten times as high as those for local calls, and MTC tariffs for calls to mobile phones were perhaps ten times as high as those for local calls (or four times as high if the mobile phones were in the same aimags as the fixed phones). When the traffic to mobile phones is split similarly (taking local calls to be analogous to calls between phones in the same aimag), these figures suggest that MTC call minutes from aimags were derived approximately 10% from national long distance calls (both subscriber-dialled and operator-connected), 60% from local calls and 30% from calls to mobile phones. In 2005, call minutes from fixed phones, WLL phones and mobile phones were 55%, 12% and 33% (respectively) of the total; subscribers to fixed phones, WLL phones and mobile phones were 21%, 3% and 76% (respectively) of the total. We combine these proportions to form the estimates used in this report. If, as in many other countries, mobile calls are shorter than fixed calls, the figures for call minutes overestimate the proportion of calls in which the first dialled digit is 0.

	Do not use 0	Use 0 for calls to geographic numbers only	Use 0 for calls to all national numbers
Calls from fixed phones only	Not a sensible option	Option 5.2.1: no change	Option 5.2.3: extend use of 0 to all national calls from fixed phones
Calls from all phones	Option 5.2.5: no national prefix	Option 5.2.2: extend use of 0 to all calls to geographic numbers	Option 5.2.4 extend use of 0 to all national calls

Figure 9 Options for use of the national prefix

Currently the international prefix (00) is not used on its own but only in international carrier selection codes. There does need to be an international prefix to satisfy ITU recommendation E.164, and 00 is the international prefix preferred.

5.2 Options for using the national prefix

Figure 10 summarises the possible treatments of the national prefix that are described at greater length later in this section and evaluates the treatments informally in terms of some of the desirable features of number changes explained in Section 3.

Option	Adequate supply of numbers and codes	Conforms with inter-national best practice	Short dialling sequences	Uniform dialling sequences	Proportions of numbers called in two different ways	Ease of implement-ing the change	Proportions[29] needing changed dialling sequences
5.2.1: no change	Poor	Bad	Good	Poor	20%	Excellent	0%
5.2.2: extend use of 0 to all calls to geographic numbers	Poor	Bad	Satisfactory	Poor	0%	Good	20%-25%
5.2.3: extend use of 0 to all national calls from fixed phones	Satisfactory	Bad	Satisfactory	Poor	100%	Good	20%
5.2.4: extend use of 0 to all national calls (keep local dialling)	Good	Good	Poor	Good	0%	Satisfactory	60%-80%
5.2.5: no national prefix and no local dialling	Good	Good	Bad	Excellent	0%	Bad	20%-40%

Figure 10 Possible treatments of the national prefix

5.2.1 No change

This option has the advantage of requiring no change in when the national prefix is used. The disadvantages of the current usage of the national prefix that are outlined in Section 5.1 ((a), (b) and (c)) would reduce over time as fixed phones reduce in relative importance. Disadvantage (b), the shared use of first digits for non-geographic and local numbering, can be reduced immediately by simply clarifying a primary use for each first digit, which we recommend in any case. We regard this as an acceptable interim measure, but it may not be the most satisfactory solution long term.

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[29] Proportions of calls (estimated on various reasonable assumptions).

5.2.2 Extend use of 0 to all calls to geographic numbers

This option requires some change in dialling patterns: 0 must be used (where it is not at present) when dialling geographic calls from WLL phones and mobile phones.

This option avoids disadvantage (a), but still has disadvantages (b) and (c) of the current usage of the national prefix, so it hardly seems worth the trouble of changing dialling patterns. A modified version of it, in which 0 would be permitted (but not required) when dialling geographic calls from WLL phones and mobile phones, may be worth considering.

5.2.3 Extend use of 0 to all national calls from fixed phones

This option requires some change in dialling patterns: 0 must be used where it is not at present when dialling non-geographic calls from fixed phones. For example, 9537 1234 would change to **0** 9537 1234 when dialled from fixed phones.

This option avoids disadvantage (b), but still has disadvantages (a) and (c) of the current usage of the national prefix, so it hardly seems worth the trouble of changing dialling patterns.

5.2.4 Extend use of 0 to all national calls

This option requires considerable change in dialling patterns: 0 must be used in many calls where it is not used at present, from all types of phone.

This option has none of the disadvantages of the current usage of the national prefix. Also, it enforces the *Mongolian Standard* for numbering. However, it entails changing dialling sequences and an extra digit for most calls. It also removes the option of using 0 to start new carrier selection codes. For these reasons we are reluctant to recommend it.

5.2.5 No national prefix

This option requires some change in dialling patterns: 0 would not be used where it is used at present (for calls from fixed phones to national geographic numbers).

This option has none of the disadvantages of the current usage of the national prefix. It is consistent with eventually abolishing local dialling; however, as we discuss in more detail in Section 5.3, local dialling can co-exist with it. The whole numbering plan becomes more uniform, with simple uniform dialling procedures (using 8 digits for most national calls, and 9 or 10 digits for some national calls to geographic numbers), particularly if local dialling is abolished. This kind of numbering plan is coming into use in many countries, especially as the use of mobile phones becomes more widespread than the use of fixed phones.

5.3 Options for dropping local dialling

Abolishing local dialling involves a change in dialling patterns for fixed network customers, and involves dialling more digits for local calls. This has particular impact on customers in aimags and soums, where local dialling at present needs only 4 or 5 digits instead of the 8 or 9 that would be needed with full national dialling.

Initial feedback from the industry and CRC is that Mongolia could be ready to drop local dialling within a few years[30]. The main prerequisite is that charges for local and national calls to geographic numbers should be fairly similar, so that the national dialling procedure is no longer needed to warn callers of especially high rates. Already tariff rebalancing is bringing these charges closer together.

[30] MTC may need an exception for a few small old soum exchanges, which have never had long-distance dialling and will not be modernised.

Figure 11 shows in rough terms how much the first digits 2 to 7 are used for local numbers in Ulaanbaatar and the aimags[31].

	Ulaanbaatar	aimags
1	Short codes	Short codes and manual exchange numbers (in a few aimags)
2	Low use (Railcom and government numbers)	High use (MTC in 20 aimags)
3	High use (MTC)	Low use (MTC in 2 aimags)
4	Moderate use (MTC)	Low use (Railcom in 11 aimags)
5	WLL only	Low use (Railcom in 6 aimags)
6	Moderate use (MTC)	No use
7	No use	Low use (MTC in 1 aimag)
8	Mobile numbers and Incomnet VSAT	
9	Mobile numbers	

Figure 11 Use of first digit for local dialling from fixed phones

Key to Figure 11: high use means over 25,000 numbers; moderate use means over 10,000 and under 25,000 numbers, low use means under 10,000 numbers

As mobile and WLL usage are growing and the fixed network at best remaining stable, we expect that changes in dialling patterns for fixed network customers will eventually seem acceptable, even if they do not seem so yet. We recommend that CRC should consider the option of no national prefix, with no local dialling, as an attractive candidate for Mongolia to move towards in the longer term.

This option could be implemented in stages. In a staged approach to dropping local dialling, the following steps might be taken:

1. Drop local dialling in Ulaanbaatar but allow it in aimags (where dropping it would require dialling up to 5 additional digits).
2. Drop local dialling completely.

This staged approach (with stage 1 followed by stage 2), where local dialling is withdrawn first in Ulaanbaatar and later in the aimags, might be easier for everybody. Going straight to stage 2 without passing through stage 1 might be difficult for customers in the aimags, who would have to learn new dialling habits, and for MTC and Railcom, who would need to inform these widely dispersed customers about the changes.

5.4 Use of first dialled digits

We recommend moving quickly towards a situation where first digits of national numbers have easily recognised and consistent meanings such as those shown in Figure 12. Our long term proposals are shown in Figure 7. In the short term, care will be needed in the use of number blocks in order to move as easily as possible towards the long term objective.

[31] We do not have exact information on MTC local numbers in use. Also, local number changes have been in progress or planned during the period of this study.

	Short term use
0	National prefix for geographic calls from fixed phones
1	Short codes, and geographic calls from mobile and WLL phones
2	Local numbers from fixed phones
3	Local numbers from fixed phones
4	Local numbers from fixed phones
5	WLL
6	Local numbers (on 63 and 68 in Ulaanbaatar only, no new blocks)
7	Non-geographic
8	Non-geographic
9	Non-geographic

Figure 12 Summary of proposals for short-term use of first dialled digits

In our draft report, we highlighted the importance of avoiding conflicts on first digit 5 between Railcom local numbering in aimags and WLL numbers. Without this, there was a growing risk that fixed line customers in the NDCs where Railcom local numbers start with 5 would not be able to call some WLL numbers. During the second visit, we found that Railcom was already planning to change these numbers within the next couple of months from starting with 5 to starting with 4 (the digit officially provided for Railcom local numbers). We also found that MTC has local numbers starting with 5 in a few places[32]. Obviously, the same conflict between WLL and local numbers could arise for fixed line customers in these places, and it must be avoided. We understand that MTC is most likely to change the relevant numbers to start with 2 or 3.

Our other proposals for careful future use of first digits follow.

- Use of the number range starting with 7, which is already shared between non-geographic and local numbers, also needs to be managed with particular care. Here again, no new blocks should be allocated or opened for local numbering, and only blocks that are not used for local numbering should be available for new services. We understand that MTC has recently changed local numbers starting with 7 in Ulaanbaatar to start instead with 49, but it still has some local numbers starting with 7 in a few places.
- The range starting with 6 should be reserved for possible long term use for geographic numbers. Therefore, no new blocks should be opened for any purpose. At some point, if local dialling is to continue, the local numbers now in that range (which are in Ulaanbaatar only), or at least those that start with 63[33], should be changed so that they start with 3 or 4.
- Any new local numbering should be focused on initial digits 2, 3 and 4 only and these digits should not be used for national numbering unless and until local dialling is dropped.
- Vacant blocks starting with 8 or 9 may be used for non-geographic numbering (with 8 digits) but not for local numbers.

[32] To our knowledge, in Huvsgul (01382 51xxx, 52xxx, 53xxx), Tsagaanchuluut (01462 50xxx) and Taishir (01482 52xxx).

[33] Arguably there is no need to change the numbers starting 68, because region codes only start with 1 to 5; so putting 6 in front of them would not create a conflict with 68. However, people could still be confused about the meaning of 6.

In the long term, as discussed in more detail in Section 5.3, CRC may decide to drop local dialling, because by then:

- It is little used.
- More numbering space is needed for new services.

When old patterns of local dialling have been abandoned, first digits 2, 3 and 4 can be brought into use for new purposes. We propose that at least one first digit should be left empty to allow indefinite future flexibility.

5.5 Summary of long term options

Putting together the earlier parts of this section, and taking account of comments received during the second visit to Mongolia, we have devised five long term options. These are summarised (with examples) in Figure 13. Of course, variations on these options are also possible.

The main decisions that may be taken in future are:

- To drop local dialling (Options B, C, D and E) and to change the use of some first digits from local dialling to new national services.
- To stop using the trunk prefix 0 (Options C, D and E).
- To share the first digit 1 carefully between short codes and geographic numbers (Option C).
- To change geographic numbers so that they no longer start with 1 but with another digit, probably 6 (Option D).
- To change short codes so that they no longer start with 1 but with another digit, possibly 2 (Option E).

Figure 14 provides a high-level evaluation of Options A, B, C, D and E in terms of our standard criteria. It shows that they are fairly well balanced, with the earlier options being easier to achieve and the later ones providing more long term benefits. So long as our short term recommendations are followed, all these options remain available and there is no immediate need to decide among them.

	Key features			Example calls		
Option	**Local dialling**	**Trunk prefix 0**	**First digit 1**	**Call to fixed phone in UB from fixed phone in UB**	**Call to fixed phone in UB from mobile phone in UB**	**To police in Han-Uul District of UB from any phone in UB**
A (can still move to B, C, D or E later)	Still available on 2, 3 and 4	Still used for national calls from fixed phones to fixed phones	Still used for short codes and geographic numbers	312 345	11 312 345	134
B (can still move to C, D or E later)	None - full national dialling only	Still used for national calls from fixed phones to fixed phones	Still used for short codes and geographic numbers	0 11 312 345	11 312 345	134
C	None - full national dialling only	Not used	Still used for short codes and geographic numbers	11 312 345	11 312 345	1394 (or other code not in geographic ranges 132x to 138x), or 134 with timeout
D	None - full national dialling only	Not used	Still used for short codes but not geographic numbers	61 312 345	61 312 345	134
E	None - full national dialling only	Not used	Still used for geographic numbers and emergency short codes but not for other short codes	11 312 345	11 312 345	234

Figure 13 Summary of long term options

	Essential features		Desirable features for ease of use					
Option	**Adequate supply of numbers and codes**	**Fair to all market participants**	**Clear purposes**	**Consistent dialling sequences**	**Uniform dialling sequences**	**Conforms with inter-national best practice**	**Short dialling sequences**	**Ease of implement-ing the change**
A	Good	Good	Satisfactory	Poor	Satisfactory	Satisfactory	Good	Excellent
B	Excellent	Good	Good	Good	Good	Satisfactory	Satisfactory	Good
C	Good	Good	Good	Excellent	Good	Satisfactory	Satisfactory	Satisfactory
D	Excellent	Good	Excellent	Excellent	Good	Good	Satisfactory	Poor
E	Excellent	Good	Excellent	Excellent	Good	Good	Satisfactory	Poor

Figure 14 Summary evaluation of long term options

5.6 Recommendations for Mongolia

As indicated in Section 2.2, recommendations about the first digits of dialled numbers are for short term, medium term or long term implementation. In particular, there is an immediate need to define the uses of the first digits that are allowed if there is no change in the use of the national prefix 0 in the short term. For the medium term we suggest that local numbers should start only with 2, 3 or 4 (Option A). An immediate decision on the long term (that is, whether to adopt one of Options B, C, D, E or some other variant) is not necessary; a processes of consultation and review can guide the decision. More fully, we recommend:

1. Making no change in the use of the national prefix 0 in the short term, so it continues to be required only for calls to geographic numbers from fixed phones.
2. Adopting rules to ensure that first digits of national numbers have easily recognised and consistent meanings.
3. Restricting local numbers to start only with 2, 3 or 4 (Option A) in the medium term.
4. Consulting the industry and consumer groups about whether to adopt one of the Options B, C, D and E (or some other variant), and about which option should be adopted.
5. If a consensus is reached after the consultation, adopting the consensus as national policy and working towards its implementation.
6. If no consensus is reached after the consultation, reviewing the position every two to three years and deciding on an option when any type of numbering is becoming scarce.

6 Carrier selection codes

6.1 General aspects

6.1.1 Forms of carrier selection

There are two basic forms of carrier selection using one-stage call set-up:

- **Preselection**. The customer makes a lasting choice of service provider for all long distance calls[34]. The access service provider stores this choice in the exchange line record of the customer, and the exchange automatically routes every relevant call made by the customer according to this choice.
- **Call-by-call selection**. The customer signals his choice of service provider to the access network for each call, by providing a carrier selection code in the dialling sequence for the call.

The two are often combined by having ‘preselection with override’, in which the preselection can be overridden with carrier selection codes. Then customers make their own lasting default choices (which are used when no carrier selection code is dialled) but can still select different service providers for particular calls by dialling carrier selection codes (known as ‘overriding the default’).

Preselection is often the more complex option to implement, because it requires more agreements and procedures between service providers. However, preselection with override 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 service provider only occasionally, not 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 always dial extra digits to choose service providers, then the number of extra digits to be dialled becomes important.

Two-stage call set-up (where there is an intermediate “dial tone” or voice message after dialling the access code and before dialling the number) is another widely used option. Because it is more work for the caller than one-stage call set-up, it is not fair for new entrants to get only two-stage call set-up when existing operators have one-stage call set-up.

6.1.2 Details of one-stage call-by-call selection

As we have seen, one-stage call-by-call selection involves the caller dialling an extra digit or digits (“carrier selection code”) to signal the choice of carrier to the network.

To specify carrier selection procedures, we need to say:

- What the carrier selection codes are like; that is, how long they should be, and what digits they can start with.
- In what part of a full dialling sequence the carrier selection codes are used.

[34] There may possibly be more than one choice, with, for example, separate choices for international and national calls.

Looking at carrier selection codes in international practice, we see that:

- The codes are kept as short as possible, to make them easy for callers to use[35].
- The full dialling sequence including the carrier selection code starts with 1 in most countries, though it starts with 0 in some countries, and it starts with 9 in a few[36].

There are three different ways of using carrier selection codes within dialling sequences:

- **Prefixing**. The customer dials a carrier selection code before any national or international prefix and before the rest of the number. Any spare short code range can be used for carrier selection codes; the most common choices are 10xxx and 1xxx. For example, from the United Kingdom (UK) a customer of Superline could dial **1461 00** 976 2 372 41234 to reach a phone in Darkhan (using 1461 as the carrier selection code, before the international prefix).
- **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** 976 372 41234 to reach a phone in Darkhan (using 90 as the international carrier selection code, instead of the international prefix).
- **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 New World Telecommunications could dial **00 9** 976 372 41234 to reach a phone in Darkhan (using 9 as the carrier selection code, after the international prefix).

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 national and international prefixes (0 and 00) and with prefixed 1x, 1xx or 1xxx carrier selection codes for overriding the preselection[37].

In various countries (such as France, Hong Kong, Japan and Singapore) there have been transitions to competition that required the introduction of many more carrier selection codes. For example, in Singapore there are now two ranges for international carrier selection codes (0xx and 15xx). Service providers that are eligible for 0xx codes must have their own networks, commit to an overall investment in infrastructure of at least S$100 millions over three years from the date of licensing, and use the carrier selection codes to provide service for the mass consumer market. Resellers are eligible for 15xx codes, to which they may add one digit for indicating other services besides international dialling. Allocation procedures for

[35] However, in some countries with many competitors, carrier selection codes have become quite long (for example, 5 digits in the UK and 7 digits in the USA). As already mentioned, long codes matter less when there is preselection

[36] In principle any first digit can be used that has no other function in the dialling plan. In practice, 1 is the most common choice because traditionally 0 has been used as a national prefix and other digits (2, 3, 4, 5, 6, 7, 8 and 9) have been used as first digits in local numbers.

[37] 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). This list (still current in May 2007) or its update can be accessed at http://www.itu.int/opb/publications.aspx?parent=T-SP&view=T-SP1.

both types of codes involve classifying the available codes as more or less desirable[38]. More desirable codes are auctioned while less desirable codes are allocated by drawing lots[39].

Even if call-by-call selection is available, preselection may still be a good idea. The UK illustrates this. National long distance service providers started to compete in the UK in 1984 with call-by-call selection but without preselection. The incumbent[40] argued 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 1998 European Union rules forced the incumbent to provide preselection. It became popular with UK customers, who prefer simple dialling patterns: customers using carrier preselection rose to over 6 million in six years[41]. Even so, there is still demand for call-by-call selection, through the use of either carrier selection codes (with up to five digits) or non-geographic numbers offering two-stage set-up. Currently there are more than 400 short codes allocated for purposes that might include call-by-call selection[42]. (Service providers sometimes offer different tariffs or service features on different codes.)

6.3 The current position in Mongolia

Currently there are no **national** one-stage carrier selection codes in Mongolia. However, if there is more than one national long distance service provider some form of carrier selection will be needed. Initially call-by-call selection is likely to be implemented. The number of national carrier selection codes needed is probably less than 100 (as Argentina, for example, with 37 million inhabitants, needs only 112) but may well be more than 10.

There does not need to be a national prefix to permit preselection of national long distance service providers: the default national service provider could be selected just by dialling the national number.

The Fixed Network Identification Codes (FNICs) in Mongolia are not carrier selection codes. In Section 4.4 we recommend replacing these codes. If carrier selection codes are introduced while FNICs still exist there may be suggestions that fixed network identification codes should be interpreted as carrier selection codes: the servcos formed by splitting MTC and Railcom might be expected to have carrier selection codes 01 and 02 respectively. We believe that allocating carrier selection codes in this way would be undesirable, because:

- It would reinforce the strong market position of MTC.
- It would cause confusion, as fixed network identification codes are used only to reach destinations on the network in question, while carrier selection codes may be used to reach destinations on any interconnected network.

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[38] 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.

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

[40] Also the first alternative long distance carrier, Mercury.

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

[42] However, a rapid a survey suggests that only about 20 of these carrier selection codes for one-stage dialling are actually used now and that about 20 specially tariffed numbers are used for two-stage dialling.

- It would create problems for other potential national long distance service providers, who would have to be allocated longer, less attractive, carrier selection codes so that there would be no shortages.

Currently the carrier selection codes 001, 002, 003, 004 and 005 are allocated for one-stage call-by-call selection of **international** services. Also, approximately 14 service providers are using approximately 22 codes in the range 16xx for two-stage carrier selection (at present, only for international calls)[43]. Two-stage call set-up is more cumbersome than one-stage call set-up and does not offer fair conditions to new market entrants that would prefer one-stage call set-up. However, two-stage call set-up involving an authorisation code is useful with calling cards and communal telephones, as payment is independent of the calling line identity.

There is a view in Mongolia that because the market for international calls is small, demand for new codes will be very limited, at least from some class of "significant" service providers (identified through their investment in infrastructure, through providing "real voice" rather than VOIP, or in some other way). On this view, the current system could continue, with new "significant " service providers being allocated 00x codes (say, 007, 008), and others being allocated longer codes such as 006x, and maybe 009xx. We, however, think that this approach would be short-lived. With convergence of all services on to IP networks, and the use of soft switches, it becomes ever harder to draw clear lines between different types of carrier. Especially with a netco/servco split, we believe there could well be justified demand for more than 10 similar codes. Our recommendations reflect this belief.

If there is carrier pre-selection there needs to be a default dialling sequence that indicates the use of the pre-selected carrier. There may be no need for carrier pre-selection on international calls, because:

- Such calls are relatively rare.
- Different international carriers may be well be best for different call destinations.
- Mobile phones often have the + key configured to begin international dialling sequences[44].

Still, there is a case for having 00 on its own as an international prefix: 00 is the international prefix preferred in ITU recommendation E.164, so visitors to the country are likely to make international calls simply by dialling 00 and the international subscriber number, without identifying a carrier. This is not possible with the current arrangement in Mongolia, because the first digits of international significant numbers could be confused with digits identifying carriers (1, 2, 3, 4 and 5)[45]. The ITU recommendation is usually interpreted as requiring that the carrier selection code (if present) should precede, not follow, the international prefix 00.

If 00 is available as a default international prefix without carrier preselection, the international carrier is usually chosen by the access network provider.

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[43] In one-stage call set-up, the caller dials the called number, perhaps with a prefix or carrier selection code. In two-stage call set-up, the caller dials an access number (in this case one of the form 16xx) and then enters the called number, perhaps along with an authorisation code.

[44] It is worth noting that at present each mobile operator makes + select its own preferred international carrier (Mobicom, naturally, itself; Skytel, its associate Sky C&C; and Unitel, Railcom).

[45] For instance, if 004 420 3456 3456 is dialled in Mongolia, it routes calls through Micom (using carrier selection code 004) to the Czech Republic (using 420 as the country code); however, if it is dialled in a country using the international prefix 00 that is preferred in ITU recommendation E.164, it routes calls to the UK (using 44 as the country code) and in fact to London (using 20 as the NDC).

6.4 Options for Mongolia

Various options for carrier selection codes are possible. The table below summarises three options called Q, R and S. They are different in the following ways:

- Whether or not they keep the existing carrier selection codes (see column 2). Keeping these codes will be seen as good by existing carriers, but it may disadvantage future competitors.
- In cases where the existing carrier selection codes are kept, whether they can be used as national carrier selection codes as well as international carrier selection codes (see columns 5 and 6 for options Q and R). It is an advantage to be able to use the same carrier selection code for both national and international carrier selection.
- Whether or not the international prefix 00 can be used on its own in the way recommended by ITU (see column 3). To be able to use it is an advantage.

In all these options, there are at least 80 carrier selection codes available: new codes might start with 0 (for example 061, 062 and so on) or 1 (for example 1601, 1602, and so on[46]), but one range (such as 09xx or 169xx) would be reserved for expansion. Further points to note about these three options are:

- Options Q and R allow the existing 001, 002 etc codes to stay in use for as long as anyone wants; in fact new ones like them (006, 007, 008 and 009) could be introduced. They do not let 00 be used by itself for international calls, so instead they would introduce a different sequence, such as 000, as the international prefix for the preselected international carrier (the alternative of 010, as in Japan, could confuse people if emergency short codes started with 10).
- Option Q provides shorter international dialling sequences with the existing 001, 002 etc than with other codes, but it does not provide national dialling sequences with these codes. To be fair to all competitors, charges for these codes would be much higher than charges for other codes.
- Option R does not provide shorter international dialling sequences with 001, 002 etc than with other codes, but it provides national dialling sequences with these codes. It is fair to competitors without extra charging for these codes.
- Option S replaces the existing 001, 002 etc codes with other codes not starting with 00, so that 00 can be used as the international prefix. This could be done by allocating no new 00x codes, and requiring holders of the existing 00x codes to return their codes by a given time (say, by 2009).

Between these options are other possibilities. For example, by using charging we could encourage, rather than require, a result like option R or S, or in option Q we could make available more codes starting with 00 by making them longer (for example 0061, 0062 and so on).

[46] Incidentally, it should not be difficult to change the internet access codes on 16xx to appropriately charged full length national numbers (since these are dialled by computers rather than by human beings). This would make more 16xx codes available for carrier selection.

	Key features		Example calls (see note below)		
Option	**Existing carrier selection codes**	**International prefix 00 for preselected carrier**	**International call to the USA**	**National call to a fixed phone**	**National call to a mobile phone**
Q (can still move to R or S later)	Not changed and not followed by 00 for international calls	Not allowed	N: 068 00 1 201 234 5678 E: 003 1 201 234 5678 P: 000 1 201 234 5678	N: 068 (0)11 201 234 E: 003 not possible P: (0)11 201 234	N: 068 99 11 1234 E: 003 not possible P: 99 11 1234
R (can still move to S later)	Not changed but followed by 00 for international calls	Not allowed	N: 068 00 1 201 234 5678 E: 003 00 1 201 234 5678 P: 000 1 201 234 5678	N: 068 (0)11 201 234 E: 003 (0)11 201 234 P: (0)11 201 234	N: 068 99 11 1234 E: 003 99 11 1234 P: 99 11 1234
S	Changed and followed by 00 for international calls	Allowed	N: 068 00 1 201 234 5678 E: 043 00 1 201 234 5678 P: 00 1 201 234 5678	N: 068 (0)11 201 234 E: 043 (0)11 201 234 P: (0)11 201 234	N: 068 99 11 1234 E: 043 99 11 1234 P: 99 11 1234
Note: In the example calls, N means 'a New carrier', E means 'an Existing carrier' and P means 'with Preselection'; also '(0)' means that 0 is used in calls from fixed phones to fixed phones but not in other calls.					

Figure 15 Carrier selection options

Decisions on this topic are likely to be particularly difficult for CRC. They have a duty to protect the interests of future new competitors, but will mainly hear views from existing carriers, who will naturally resist any change (and whose co-operation is essential to successful change). In this case, decisions probably cannot be long postponed as the new codes may be needed soon. Our recommendations below are designed to help CRC to ensure availability of plenty of codes for all comers, while not forcing change on anyone.

6.5 Recommendations for Mongolia

We recommend:

1. Introducing a range of new carrier selection codes, such as 06x.
2. Not issuing any new carrier selection codes of the form 00x, and issuing existing carriers with new codes of the same form issued to new carriers.
3. Using these new codes followed by 00 for international carrier selection, and the same codes followed by 0 (if retained as the national prefix) for national carrier selection.
4. Over a period, phasing out the use of the current international carrier selection prefixes (001, 002, 003, 004 and 005), either by agreeing a sunset date for these old codes with the industry once the new codes are in operation or by charging much more for the old codes than for the new ones.
5. When 001, 002, 003, 004 and 005 have been withdrawn, allowing use of 00 as the default international prefix (with the carrier to be chosen, where possible, by carrier preselection, and otherwise by the access network service provider).
6. Clarifying (as a matter of competition policy) which class of access service providers must provide carrier selection facilities for which class of carriers, and how and on what

conditions access service providers may choose default carriers (such as the meaning of + from mobile phones).

7 Mobile numbers

This section deals with mobile NDCs and subscriber numbers. Mobile short codes are discussed in Section 10 and mobile number portability in Section 14. International Mobile Subscriber Identities (IMSIs) are mentioned in Section 16.

7.1 The current position in Mongolia

Currently the numbers for mobile phones and WLL phones that are registered outside Ulaanbaatar incorporate aimag codes to identify where the phones are registered. Because of this scheme, calls from fixed phones to mobile phones registered in the same aimag can be recognised by callers and be charged by service providers at lower tariffs than other calls.

The scheme can be exploited in a way that was not intended: someone can register a phone in a remote aimag and can use the phone in Ulaanbaatar for cheaper calls involving that aimag. In practice this usage is much like that provided by 'friends and families' discounts[47]. It could be prevented by testing whether the phone is in the aimag before generating the call detail records for billing, much as mobile service providers in other countries do when supporting 'home zone' discounts[48].

Like other discount arrangements, the scheme is not cost-based, as networks interconnect in Ulaanbaatar, not in aimags. Arguably, charging the economic cost for calls would promote more rapid development of the networks and would ultimately benefit people more than subsidising some calls. This is not a numbering matter, so we do not discuss it further here.

What interests us here about the scheme is that it uses numbers to provide tariff information to callers. It does not do this perfectly: some mobile phone numbers use extra aimag codes (because there can only be 10,000 numbers per aimag code), so callers need to remember to which real aimags the extra aimag codes correspond. Extra aimag codes may create confusion about which aimag codes apply where, especially if different service providers introduce different codes. For example, Mobicom has now introduced Darkhan mobile numbers in the extra ranges 99 39xxxx and 99 40xxx as well as in the original range 99 37xxxx. The fixed networks do not use aimag codes 39 and 40.

This feature of the scheme will create problems when even more mobile phones are registered outside Ulaanbaatar. If there are no extra aimag codes, a mobile NDC such as 88, 91 or 99 can only provide 240,000 numbers (not 400,000) outside Ulaanbaatar[49]. Also, because for each mobile NDC there can only be 10,000 numbers per aimag code, there are likely to be more shortages of mobile numbers for aimags.

The numbers for mobile phones and WLL phones that are registered inside Ulaanbaatar have third digit (the first digit after the NDC) 0, 1, 6, 7, 8 or 9. The mobile service providers have chosen to use the third digit (and sometimes the fourth digit and even the fifth digit) to indicate variants of their services; for example, the third digit 6 often means a service for

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[47] A "friends and families" discount allows a customer to identify certain numbers; calls to those numbers will then have lower charges than other calls.

[48] A "home zone" discount allows a customer for a mobile service to identify a particular location; calls from that location will then have lower charges than other calls. Calls to that location may also have lower charges, especially if they are made to a geographic number for the location that is associated with the mobile phone.

[49] The figure of 240,000 is calculated by noting that there are 10,000 numbers available for each of Baganuur, Babakhangai and Nalaikh, and 10,000 numbers available for each of 21 aimags.

students. This practice, too, is likely to produce shortages of numbers, because some variants of services may exhaust their supplies of numbers well before others do.

The following factors may also produce shortages of numbers:

- Customers have preferences for or against particular numbers (such as those involving 11 or 77)[50].
- Mobile prepaid services tend to consume more numbers than they have customers, because:
  - Customers often get new numbers, and it is hard for operators to re-use their unused old numbers.
  - Each customer may have more than one number, because they have more than one SIM card or phone (for reasons of tariffing or fashion)[51].

In fact, already extra NDCs (95 and 96) have been allocated to mobile service providers, so 6 million numbers (with NDCs 88, 91, 95, 96, 98 and 99) have already been allocated to mobile service providers. If Mobile Number Portability is introduced, then the identity of the mobile service provider will be lost from the number, making possible more flexible and efficient use of this large numbering resource.

7.2 Options for Mongolia

The options considered in this section relate to the treatment of aimag codes in numbers for mobile phones and WLL phones. However, numbers for mobile phones present other problems, because there could be shortages of them for other reasons besides the use of aimag codes. These problems can be solved using some of the treatments of aimag codes discussed in this section.

During the second visit to Mongolia by the consultant, we were told that the need for identifying aimags in mobile numbers would soon end. If this indeed happens, then much of the discussion below will be unnecessary. We have however left it in the report in case it is needed after all.

7.2.1 Making extra aimag codes more systematic

This option continues the present system, but tries to make life easier for callers by allocating extra aimag codes in a systematic way that is common to all mobile operators. (At present, each mobile operator appears to be deciding for itself how to increase aimag numbering capacity when needed.)

With this option, CRC would establish a list of extra aimag codes for aimags at risk of exhaustion. (We understand that this would simply be formalising an arrangement that already exists among the mobile operators). These extra aimag codes would be used consistently by all of the mobile operators needing extra numbers in a given aimag, to help customers to recognise the codes. Preferably, for easier recognition, the extra codes would be in some way similar to the exhausted code, but we recognise that this is hard to achieve.

This should provide enough numbers per mobile NDC for several years.

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[50] Estimates of the proportion of preferred numbers in a mobile NDC vary. One suggested in Mongolia is that there are 20,000 preferred numbers per mobile NDC.

[51] In South Korea (in 2003) and Turkey (in 2006) there were more than 70 mobile phones per 100 inhabitants; in Luxembourg, which has the highest penetration in the world, there were 170 mobile phones per 100 inhabitants in 2006.

7.2.2 Moving to a relation between mobile tariffs and region codes

This option is less restrictive than the present arrangement but keeps a form of "local discount" tariffing. It would let a mobile service provider supply numbers from one tenth of a mobile NDC throughout a region (defined in the aimag code by the first digit 2, 3, 4 or 5). Call charges would be uniform throughout the region where a phone was registered. We assume that this tariff would be higher than the current "aimag" one but lower than the current "national" one, so it could represent a step towards implementing option 7.2.3 later.

This would provide enough numbers per mobile NDC for some years. From a numbering point of view, it is acceptable. If the tariff policy change needed for the option in Section 7.2.3 does not take place, then this option (which combines both tariff policy and numbering policy) may be worth considering.

7.2.3 Removing the relation between mobile tariffs and aimag codes

This option would let a mobile service provider supply numbers from an entire mobile NDC throughout the country. Call charges could depend on where a call was made but would not depend on where a phone was registered. Callers could not check whether calls were cheaper from certain locations just by looking at the numbers to be dialled; in practice this might not matter, as many of their calls would be to friends and families in known locations.

This would provide enough numbers per mobile NDC for several years. From a numbering point of view, it is good. However, its adoption depends on a change in tariff policy.

7.2.4 Increasing the supply of mobile numbers

This would be a good approach if there turned out to be a need for more mobile numbers in any case (which looks unlikely at present). More mobile numbers can be introduced by either creating new mobile NDCs or lengthening mobile numbers[52].

To ensure that numbers can be lengthened, a particular third digit for the numbers in each NDC should be left unused, so that when the numbers have to be lengthened it can be inserted in all the used numbers. For example, if all numbers in the range 897x xxxx are spare, then the NDC 89 can be given 10 times as many numbers as it had, by first inserting 7 as a new third digit in each existing number in the range 89xx xxxx (to move it to the range 897xx xxxx) and then allowing digits other than 7 as the third digit in numbers. We recommend that this option should be kept open for the indefinite future in case it is needed.

7.3 Recommendations for Mongolia

We recommend:

1. If possible, removing the relation between mobile tariffs and aimag codes, and providing any "local discount" tariffs on another basis, such as using 'friends and family' or 'home zone' arrangements.
2. If tariff policy does not permit the first option straight away, considering as a step towards it an arrangement whereby numbers relate to regions rather than to aimags, and "local discount" tariffs (at a level between current national and aimag tariffs) are offered for the region rather than just for the aimag. Numbers would be available throughout the region to relieve any shortages in aimags.
3. If the first recommendation is not possible and the second is not agreed, identifying 'extra aimag codes' for each aimag where mobile numbers are likely to reach exhaustion and requiring that all of the mobile service providers use them when they need more numbers.

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[52] In principle, another 9 mobile NDCs could be created using currently vacant 9x or 8x codes.

4. Requiring that existing allocations of numbers are highly used before new allocations are made.
5. Requiring that for each mobile NDC one particular third digit of the numbers remain unused, to let the numbers be easily lengthened in the future, if necessary.

8 Nomadic numbers

8.1 The current position in Mongolia

Currently fixed phones have geographic numbers while WLL phones and mobile phones have non-geographic numbers[53]. Most numbers for WLL phones have first digit 5[54]. The first digit was changed from 9 to 5 in early 2007 to make the difference in tariffs between calls to WLL phones and calls to mobile phones clearer to users and to make more numbers starting with 9 available for mobile phone numbers.

WLL phones are initially substitutes for fixed phones, not for mobile phones. There is therefore a case for giving them geographic numbers. However, using non-geographic numbers (instead of geographic numbers) for WLL phones is in keeping with a worldwide trend to have 'universal access licences' that permit WLL phones to be used as mobile phones. Though WLL phones can be limited to particular areas (such as the coverage areas of individual base stations) such limitations are rather artificial and sometimes irrelevant: a 450MHz wireless base station might cover an area with a radius of 50km. A customer might wish to change from using a WLL phone service to using a mobile service by increasing the rental payment or contributing to call costs in such a way that callers still paid no more than they would for calls to a WLL phone; in this case the customer would not expect a change of number.

The widespread use of wireless Internetwork Protocol (IP) systems such as WiFi and WiMax will be accompanied by an increased use of Voice Over IP (VOIP). Both wireline and wireless VOIP services are usually 'nomadic', in that a user can make or receive calls anywhere that the terminal is attached to the network. Wireless VOIP services can even be mobile: they can already hand over calls between cells and will soon be the subject of roaming agreements. Thus for VOIP services, as for WLL services, the distinctions between no mobility, limited mobility and full mobility should not always constrain the numbering. In many countries, therefore, VOIP services may have both geographic numbers and non-geographic numbers; sometimes (as in Austria, Germany and Ireland, for instance), customers must satisfy residence requirements if they are to get geographic numbers[55]. The non-geographic numbers differ from those for mobile services because of the difference in tariffs.

Soft switch phones can provide VOIP services that are essentially nomadic. In Mongolia, the services are currently available only in Ulaanbaatar. Nonetheless, soft switch phones have 8-

[53] Popularcom have a geographic substructure for their 588 xxxxx number block. However, as this is not intended to be meaningful to the public, we regard their numbering as still essentially non-geographic.

[54] However the numbers for WLL phones on the government network have first digit 9: their NDC has not changed from NDC 92 to 52 yet. In fact, WLL phones on the government network might be expected not to have their own NDC, as the government network is not a public network

[55] In Japan, there are requirements about quality of service. 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. Services having non-geographic numbers should have delays of less than 400 milliseconds; whether they should be able to access emergency services is under discussion.

digit numbers that are non-geographic in the sense that their NDC (70) does not specify a geographic area associated with the recipient of calls[56].

There are various points to bear in mind when choosing between geographic numbers and non-geographic numbers for nomadic services, such as soft switch services and WLL services:

- Geographic numbers are often preferred by customers because of their familiarity and established tariff structure.
- Geographic numbers encourage competition between fixed networks.
- Non-geographic numbers avoid making any shortages of geographic numbers worse (but such shortages are unlikely to arise in Mongolia).
- Non-geographic numbers avoid implied, and sometimes unenforceable, claims about the locations of the phones receiving calls.
- Non-geographic numbers support number portability more fully than geographic numbers, in that they do not let geography constrain whether a number can be ported.
- Non-geographic numbers indicate the distinctive nature of the service (though this is not applicable to WLL services that are simply substitutes for fixed services).

This suggests that both geographic and non-geographic numbers have advantages that service providers might want to exploit. When regulation is light-handed, service providers can be allowed to have both geographic and non-geographic numbers if the following conditions are satisfied:

- Users must not be misled about the tariff levels for the service through the numbers. If the tariff levels are subject to standard rules to relate them to NDCs and local calling areas, users are unlikely to be misled.
- Users must not be misled about the bad points of the service through the numbers. In practice, the main problem here is that nomadic services having geographic numbers may provide misleading information in emergency calls.
- Other services can still have enough numbers. In practice, the main problem here occurs when the numbers are geographic and the other services are fixed services in capital cities.

8.2 Options for Mongolia

The options considered in this section relate to the use of geographic numbers and non-geographic numbers for nomadic services. Soft switch and WLL services can be nomadic.

8.2.1 Letting nomadic services have geographic numbers only

This option restricts nomadic services to having only geographic numbers, so numbers for soft switch and WLL services would need to be changed or reinterpreted as geographic numbers. It could only be recommended if there were strong arguments in its favour, as WLL numbers have changed very recently. In fact, the general points discussed in Section 8.1

[56] MTC does however have in mind a geographic substructure for the 70 range, when it is used outside Ulaanbaatar (to date, only 7011 xxxx has been used, inside Ulaanbaatar). We hope that like the Popularcom substructure mentioned above, this is for internal management purposes and not designed to be meaningful to the public. We advise strongly against having more than one geographic numbering structure visible to the public – this would be both confusing to callers and wasteful of numbers.

suggest that the option is not very satisfactory. There could also be some difficulty in routing to such numbers if they must start with 2, 3 or 4 as would be the case with Option A of Section 5. (Once local dialling has stopped, other first digits can be used and this difficulty is reduced).

The option would be accompanied by conditions on the use of numbers, as outlined in Section 8.1. These conditions might then prevent customers from retaining their numbers when their services were made more mobile without being made more expensive.

8.2.2 Letting nomadic services have non-geographic numbers only

This option restricts nomadic services to having only non-geographic numbers.

The non-geographic numbers should reflect the likely tariffs for calls. As CRC recognises, the use of mobile numbers does not generally do this. Nomadic services for VOIP may become as common as mobile services after some time, so if mobile numbers are intended to have first digit 8 or 9, nomadic numbers should have a different first digit.

As indicated in Section 9.4, we consider that the main determinant of the first digit in a number should be the tariff ceiling for the service. Some nomadic services (such as VOIP services) are likely to have tariffs at or below local tariffs for calls from fixed phones; others are likely to have tariffs lying between the local tariff and the national long distance tariff or the mobile tariff. We suggest that different NDCs, and even different first digits of NDCs (where possible), be used for different tariff ceilings.

8.2.3 Letting nomadic services have geographic numbers and non-geographic numbers

This option provides a choice for nomadic services, between geographic numbers and non-geographic numbers.

Both the geographic numbers and the non-geographic numbers should reflect the likely tariffs for calls. As indicated in Section 8.1, initially customers may prefer geographic numbers, so this option stimulates competition. Later, as tariffs decrease or features increase, customers may prefer non-geographic numbers that suggest more mobility.

8.3 Recommendations for Mongolia

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.
   - Other services with strong claims to geographic numbers can still have enough numbers.
   - All interconnected networks can route calls to the numbers.
2. Allowing all services to have non-geographic numbers provided that:
   - All calls to the numbers have call charges at or below tariff ceilings set by CRC for the NDCs of the numbers.

9 Specially tariffed numbers

9.1 General aspects

Non-geographic numbers other than mobile ones are often used, for example for services of the following sorts:

- **Freephone services**. Calls to freephone ('toll free') services (with numbers usually beginning with 800) are paid for by the recipients of the calls: money passes from the recipients of the calls to the network operators. They are likely to be popular and are not likely to put consumers at risk.
- **Shared cost services**. These are typically used by call centres, who might be providers of useful public information such as train times. The costs of calls to shared cost services are shared between the callers and the recipients of the calls: money passes from both the callers and the recipients of the calls to the network operators. The recipients of the calls expect to cover some of their network costs in offering information to callers. (However, the network costs may be much less than the call centre costs.)
- **Shared revenue services**. These are often known as 'premium rate services'. They can be very expensive and are therefore often regulated in various ways. Revenues for calls to shared revenue services (with numbers frequently beginning with 900) are shared between the network operators and the recipients of the calls. The recipients of the calls expect to make profits, even after accounting for their network costs and call centre costs. They might, for instance, provide call-by-call carrier selection services that do not use carrier selection codes or require end users to have accounts with the selected carriers.
- **Personal number services**. These typically let the recipients of the calls choose the numbers, the locations at which they receive calls and even the charges paid to callers (so they could be freephone, shared cost or shared revenue services). If the charges are high, personal number services may turned into “unofficial” premium rate services that bypass premium rate service regulation. In the form of Universal Personal Telephony (UPT) such services have been more discussed than deployed, except perhaps where they are essentially nomadic services.
- **Corporate number services**. These typically let organisations choose single non-geographic number blocks (and perhaps single tariffs for incoming calls) for all their locations. In most countries relatively few corporate numbers seem to have been allocated. Potential customers do not in general see advantages in corporate number services over freephone and other specially tariffed services, or in having a relation between corporate numbers and internal Virtual Private Network (VPN) numbers.

9.2 Experience in other countries

Several kinds of information have been provided in non-geographic numbers in various countries. The kinds of information that are most commonly provided are the degree of mobility (discussed in Section 8.1) and the tariff level.

Opening new non-geographic number ranges without very clear criteria for the allocation, tariffing and use of the numbers risks the reputation of all non-geographic numbers (except those that are very distinctive and familiar, such as for freephone). Having large numbers of spare numbers may tempt a regulator into introducing number ranges that are not well understood and may be misused.

The UK is one country in which there have been such number ranges. In the UK there have been personal, corporate, nomadic and mobile numbers as well as freephone, shared cost and shared revenue numbers (with several tariff bands for the shared cost and shared revenue numbers)[57]. Because these schemes have led to many difficulties, they are now to be replaced with others that are subject to more rules. For example:

- Personal numbers have been misused (as unsupervised premium rate numbers) and have lacked any clear or consistent tariff structure. The regulator has decided that personal numbers are now to have ceilings on their tariff rates (unless they provide free announcements of the charges at the starts of calls). Any personal numbers that continue to be used legitimately for "find me / follow me" services may ultimately be moved to a new number range, to distinguish them more sharply from nomadic and mobile numbers[58].
- Corporate numbers have not proved popular: the few number blocks in public use have been used for residential VOIP numbers, not for corporate numbers. The regulator has not decided on a general allocation process or on the tariff arrangements.
- Shared cost numbers have become puzzling to callers: their call charges were originally set to be local and national long distance call charges of BT, which have now have fallen steeply and which do not necessarily match the call charges of alternative service providers. The regulator has decided that some shared cost numbers will have call charges matching those in the tariff package of the callers (unless there are free announcements of the charges at the starts of calls) and that others will be regarded as shared revenue numbers[59]. The services may also be moved to new number ranges, to mark them out more clearly.

Though the case of the UK may be more extreme than others, in several countries there are number ranges that are not well understood and may be misused, partly because the numbers have been used to provide kinds of information other than the tariff level.

A country in which the introduction of corporate numbers has been more successful may be the Netherlands. In the Netherlands there has been a well publicised allocation process for these numbers during the past two years. In that time more than 950 000 numbers, in 1,300 blocks, have been allocated. Almost 84% of these allocated blocks have 100 numbers, 12% have 1,000 numbers, 4% have 10,000 numbers and the remaining two have 100,000 numbers[60].

Personal numbers and corporate numbers may differ from other numbers in their allocation processes. The allocation process does not matter to callers but the tariff level does matter.

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

[58] 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 detailed choices for subscribers more easily than traditional systems.

[59] The tariff package of the caller is the set of prices determined by the contract of the caller. This might say, for instance, that long distance calls were free at some times of day or that calls to mobile phones had the same tariffs as national long distance calls.

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

9.3 The current position in Mongolia

Currently there are very few specially tariffed services in Mongolia[61]. There are no such services available on national numbers. There are some freephone and premium rate services available on short codes that are different for fixed phones and mobile phones.

The use of the range 1 1 800 xx xxxx (where the first two digits beyond 800 would be a value added service provider code) has been suggested for freephone services. However, the numbers would then identify an access service provider (MTC in Ulaanbaatar) and convey the impression that freephone services were generally provided through the MTC network.

The numbers for the government network can be regarded as very unusual corporate numbers. In particular, the numbers for WLL phones on the government network are non-geographic numbers, with their own NDC (92).

9.4 Considerations for Mongolia

9.4.1 Classification of specially tariffed numbers

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

- Location.
- Tariff level.
- Length of number.
- Access service provider.
- Access network protocol (analogue, digital or IP).
- Allocation process (by the regulator, by an industry body or by a service provider).
- Nature of content.
- Degree of mobility (fixed, nomadic or mobile).
- Variety of media (voice, video or text)[62].

Using numbers to make elaborate distinctions between classes of call does not help users much and can lead to disputes about whether service providers are entitled to use certain numbers. It leads to confusion and distracts attention from what matters to users, as indicated in Section 9.2. In particular, the problems associated with identifying the access service providers in numbers are described in Section 4.1, and the problems associated with incorporating the degree of mobility in numbers are discussed in Section 8.1. In general, we do not favour making elaborate distinctions that include different kinds of information in numbers.

[61] In this report, a specially tariffed service is a service that has tariffs unlike those for standard conversational voice calls or text messages to acquaintances. The service might be free (as with freephone services), expensive (as with premium rate services) or somewhere between (as with shared cost services). A specially tariffed service may provide voice calls or text messages, typically between a customer and an information provider.

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

9.4.2 Pricing for specially tariffed numbers

Simple distinctions in numbers, to tie them to tariff ceilings (for example, no more than 100 ₮ a minute), can improve tariff transparency. Tying numbers to tariff ceilings need not require the regulator to determine tariffs for services: the regulator could require the use of certain non-geographic numbers for certain tariffs and the service providers would choose the tariffs for their services. (There could also be exemptions for calls starting with free announcements about the charges.) The tie between numbers and tariff ceilings can take one of the following forms:

- **Absent**. The tariff ceilings would not exist. However, before every voice call or text message a free warning would be announced or displayed.
- **Absolute**. The tariff ceilings would be determined by the regulator and adjusted by the regulator, either by applying rules automatically each year or by conducting reviews.
- **Relative to other expectations of customers**. The tariff ceilings would be clearly related to the tariff packages of the callers. (For instance, they might state that for calls to certain numbers the charges would be not more than the charges for national long distance calls, or not more than twice the charges for local calls from fixed phones, or twice the charges for on-net calls from mobile phones.) Tariff packages might be allowed to make exceptions for certain non-geographic numbers if the exceptions were prominently displayed in customer contracts and bills. There would be no need to have regulation of the tariff ceilings other than any that existed for other purposes; callers would need to understand how the numbers and local calling areas affected the tariffs.

The called party would also make rental or call-by-call payments; some of these might be transferred by interconnection payments to different service providers 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[63]. However, it can complicate interconnection negotiations (especially when the tariff ceilings are relative).

We suggest tying non-geographic numbers mainly to tariff ceilings. Some of the tariff ceilings would be absolute (for freephone services) and some would be related to the tariff packages of the callers. There would be at least one tariff ceiling that would limit charges to the local tariffs for calls from fixed phones (typically for VOIP services); there might be other tariff ceilings lying between the local tariff and the national long distance tariff or the mobile tariff (as there is a large difference between these tariffs in Mongolia). We see no reason to introduce new number ranges to limit charges to the mobile tariffs for calls from fixed phones: the existing mobile number ranges could be used instead[64].

9.4.3 Regulation of specially tariffed numbers

Customers must get the specially tariffed services that they want and pay no more than they expect. We suggest that CRC put in place measures to ensure this. These measures might include, for example, suitable combinations of the following:

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[63] 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.

[64] Services in which the recipient of the call can benefit financially by increasing the cost of the call to the caller (typically by increasing the length of the call) are exceptions to this. These services are usually shared revenue services, but they might be shared cost services. So that callers are warned, these services should not use numbers for conventional fixed or mobile services but should instead have their own number ranges, such as 90 for premium rate numbers, with their own tariff ceilings and other consumer protection rules.

- Requiring users to confirm their understanding of the tariff that will be charged before actually being charged for the value added service. (This might be done, for example, by pressing a certain key as part of a call or of an exchange of messages, or by replying to an initial uncharged call or message within a certain time.)
- Requiring that any calls to such numbers, especially if they involve conversation as well as or instead of Interactive Voice Response (IVR), have time-independent charges. (Calls that involve conversation are obvious additions to many information services.)
- Providing an easily accessible route for any complaints of wrong charging or unsatisfactory service, which will be dealt with promptly and fairly.
- Ensuring that short code ranges starting with 80 are not used except for freephone services.
- Confining to particular number ranges, such as 90, services in which the recipient of the call can benefit financially by increasing the cost of the call to the caller.
- Requiring that access to certain (expensive) numbers be barred from any phone, unless the user of that phone has requested unbarred access.

Generally voice calls are more difficult to regulate effectively than text messages, because they can provide ‘live’ conversation and they need more complicated implementations to state, and let customers accept or reject, tariff conditions. (A premium rate text message can be one message in a sequence: the customer sends a message to request the premium rate content, the service provider sends a message to announce the tariff conditions, the customer sends a message to accept the tariff conditions, and the service provider sends the premium rate content.) CRC might therefore choose to prohibit premium rate voice calls, or at least those charged above a certain maximum level, but permit premium rate text messages.

9.4.4 Treatment of government numbers

The arrangements for the government network outlined in Section 9.3 create the following problems:

- They leave the tariffs of calls to the government network unclear; for example, calls to WLL phones on the government network might have the same tariffs as calls to mobile phones.
- They provide corporate numbers, but corporate numbers are not available to any other large organisation, though there could easily be larger organisations than the government;

We do not advocate introducing corporate numbers in Mongolia. Instead we suggest that the arrangements for the government network be changed so that it is no longer treated differently from other private networks.

9.4.5 Choices of ranges of numbers

In many countries freephone numbers begin with 800 (or at least 80). In several countries premium rate numbers begin with 900 (or at least 90). In Mongolia some NDCs with first digit 8 or 9 are already allocated to mobile numbers. However, NDCs 80 and 90 are not allocated, and could follow widespread international usage. In addition, NDCs 20, 30, 40, and 60 are not allocated[65]. We suggest that all these NDCs be reserved for the time being. In due course they could be used for services offering information (as opposed to services offering conversations with friends and families) with appropriate tariff ceilings, or for other uses requiring distinctive numbering.

9.5 Recommendations for Mongolia

We recommend:

1. Consulting the industry and consumer groups about non-geographic numbering classes, dealing with, in particular:
   - Which kinds of information should be embedded in non-geographic numbers.
   - How many tariff ceilings for non-geographic numbers would be needed, and how many numbers would be needed for each tariff ceiling.
   - Which (if any) current numbers should be moved to fit the NDCs for specially tariffed numbers
2. Introducing consumer protection arrangements for specially tariffed services, bearing in mind the possibilities for barring messages, introducing messages about tariffs, and associating tariff or content information with number ranges.
3. Treating the government network no differently from other private networks, without special network identification codes or NDCs.
4. Dedicating 80xx xxxx to freephone services and 90xx xxxx ranges to premium rate services. Some shorter ranges, for example of 6 digits, may be considered for services such as SMS and MMS that may be used on the move.
5. Reserving NDCs 20, 30, 40, and 60 for information services at special tariffs or other future applications requiring distinctive numbering.

[65] Some local numbers in Ulaanbaatar begin with 30 but the NDC 30 is not allocated and does not conflict with the local numbers in Ulaanbaatar. However, NDC 50 is allocated for WLL phones on the MTC network.

10 Short codes

10.1 General aspects

10.1.1 Major uses of short codes

In many countries there are short codes beginning with 1 (and often having just three digits). These codes are available on both fixed phones and mobile phones, at least if they provide access to services (such as emergency assistance) that are independent of networks.

Mobile networks analyse dialling sequences ‘en bloc’ (after the whole number has been sent) rather than digit-by-digit and do not offer local dialling[66]. They therefore have more opportunities for creating short codes: in principle they can create short codes using any unused combinations of digits. They can also use short codes not just for voice calls but also for text messages.

The numbering plan for the Short Messaging Service (SMS) is technically separate from the plan for telephony. However, for messages to subscribers it uses national numbers that by convention are normally the same as the national numbers for voice calls to the same mobile phones[67]. In some countries, 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 as value added services, often accessed by dialling short codes (typically of five digits) that regulators have played no part in allocating. If regulators try to intervene, service providers may point to the difference between national numbers and short codes. However, co-ordination between SMS numbering and telephony numbering would 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 given the convention that national numbers for SMS messages to subscribers are the same ones used for voice calls to subscribers).
- Service providers might wish to provide voice and text information on the same number (so, for example, the code 34567 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 service provider 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 service provider or even a direct customer of the service provider.) Certainly some service providers have been reluctant to achieve interconnection between different mobile access networks for SMS messages using short codes.

[66] WLL phones in Mongolia also offer only national dialling. Informants differ as to whether they use only ‘en bloc’ dialling or whether digit-by-digit sending is also possible form them.

[67] For several years the first implementation of mobile number portability, in Singapore, provided portability for voice calls but not for text messages.

10.1.2 Other uses of short codes

The following services besides SMS use numerical identifiers in GSM networks:

- The Multimedia Messaging Service (MMS) can use email addresses or national numbers to deliver messages to subscribers (again with the convention that messages to subscribers use copies of the relevant national 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. The position for CDMA networks is similar but not identical.
- Unstructured Supplementary Service Data (USSD) uses short codes in the in the range 1xx (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 the second digit is 0, 1, 2, 3 or 4 and by the visited network if the second digit is 5, 6, 7, 8 or 9; ETSI specifications do not standardise the interpretations. (ETSI specifications do, however, standardise the interpretations of codes for supplementary service features on mobile phones.) There is no counterpart to USSD in CDMA networks.

10.2 Experience in other countries

Short codes in the range 1xx have usually been used for customer services provided by fixed access service providers (including fault reports, operator services, directory enquiries and sales enquiries). In many countries, they are also used for emergency assistance.

Without competition, the 100 short codes offered by 1xx 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). Allocating them liberally, even when there is no competition, is not always desirable. For example, in some countries there are so many emergency numbers that worried users might dial the wrong ones; having one central number from which calls would then be passed to the right emergency assistance services could be faster and safer.

With competition, the demand for short codes has increased because:

- 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, 108 for reporting faults on network A when using a phone connected to network A, and 108 for reporting faults on network B when using a phone connected to network B) this is relatively easily handled. (There is one small 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.) When existing service providers have exclusive codes, competition can increase pressure on 1xx 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 exhaust the spare short codes rapidly. (For instance, in Chile, with over 50 alternative service providers, more than half of the 1xx number range is used in this way.)

Short codes are often seen as particularly suitable for international harmonisation efforts, because some of the services that they offer (such as emergency assistance) are often needed by travellers and because the same short codes may be spare in different countries. For example:

- In South Asia the codes 100, 101 and 102 have been recommended for emergency calls (for police, fire and ambulance respectively).
- 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 European Union (EU) and is now known by 35% of the general public in the EU[68]. (Often older, familiar, emergency codes have been retained alongside it.) It has also been adopted widely in other countries, at least for GSM networks.
  - The code 116 (possibly extended to 116x, 116xx or 116xxx) is to be used for free calls to public services. So far one extension has been announced (to 116000, for missing children).
  - The code 118 (possibly extended to 118x, 118xx or 118xxx) is used for directory enquiry calls in several countries.

If international harmonisation is wanted in Mongolia, then practice in Japan and South Korea has obvious relevance. The most important short codes are likely to be those for emergency assistance services and directory enquiry services[69]. Emergency assistance services use 119 in both Japan and South Korea. Directory enquiry services use 104 in Japan and 114 in South Korea.

Many countries are developing their 1xx short codes in ways that give a special significance to particular values of the second or third digit. Often the second digit of a short code (following the first digit 1) is used to identify a particular class of short codes. Typical classes are:

- Codes for essential services, such as emergency assistance, 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 codes are regarded in some countries (such as the Netherlands) as scarce resources that should be reserved 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 numbers in “short code” space (although many of the numbers are actually

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

[69] For Mongolia, we do not have figures to justify this suggestion. Indeed, we know that in some countries there are other popular short codes, such as those for “speaking clock” services.

long[70]) and rights of use of the “short codes” are auctioned, with reserve prices and preferential treatment for charities.

Codes might need to be chosen carefully and harmonised between networks to avoid unfortunate and even dangerous mistakes (for example where an entertainment service is called instead of an emergency number). There is particular scope for confusion if short codes for other purposes (such as SMS and MMS) contain * or #.

In some countries, mobile service providers 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 and so that consumer protection measures can be implemented collectively. This is so in the UK, France and South Africa, for instance[71]. However, in other countries, such as Ireland and Finland, there is more direct involvement by the regulator.

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

Concerns have been growing in the EU about promoting competition and protecting consumers if short codes are officially unregulated. An official report[72] has recently urged regulators in the EU 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 associating tariff or content information with number ranges).

10.3 The current position in Mongolia

Currently short codes are mainly available on the fixed network in Ulaanbaatar.

Figure 16 shows one view of the short codes available there, based on the most recent information from CRC.

[70] This situation has arisen for historic reasons and is not to be seen as a pattern for copying elsewhere. It has the disadvantage that the specially tariffed services cannot in general be accessed internationally.

[71] For example, the South African Wireless Application Service Providers’ Association, run by the value added service providers in South Africa, has websites with some hundreds of complaints lodged by competitors and members of the public since the code of practice was launched in 2004. However, among these hundreds of complaints, however, only tens are regarded as valid. See http://www.waspa.org.za and http://www.smscode.co.za/.

[72] Report 088 on SMS numbering at http://www.ero.dk/documentation/docs/doccategory.asp?catid=4&catname=ECC/ERC/ECTRA%20Reports

	0	1	2	3	4	5	6	7	8	9
10	Emergencies						MTC operator assistance			MTC directory enquiries
11	Premium rate 1109	Mobicom customer services	Mobicom customer services	Mobicom customer services	Mobicom customer services	Mobicom customer services		MTC long distance enquiries 117xx[73]		
12		Engineering tests								Engineering tests
13				Police in different districts	Police in different districts	Police in different districts	Police in different districts	Police in different districts	Police in different districts	Police in different districts
14	MTC supplementary services [74]	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services
15	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services	MTC supplementary services
16	ISP and VOIP access 16xx									
17										
18		Premium rate 181x	MTC fault reports 18xxx[75]						Premium rate 188x	
19	Premium rate 19xx									

Figure 16 Use of short codes from MTC fixed phones in Ulaanbaatar

Key to Figure 16:

Continuing conflict with geographic codes

The row identifies the first and second digits and the column identifies the third digit.

Figure 16 shows that:

- The codes can be classified in several ways but provide few patterns that could help users to recognise the likely uses or tariffs for codes.

[73] The MTC 117xx enquiry codes are allocated to small districts in Ulaanbaatar in a logical way, with the last two digits matching the branch office number They exclude many codes that do not correspond with small districts.

[74] The 14x and 15x codes are allocated in matched pairs for activating and deactivating supplementary service. For example, 148 activates call waiting, while 158 deactivates call waiting. The same effects are obtained using *48# instead of 148 (and so on).

[75] The MTC 18xxx customer service codes are allocated to exchange areas in Ulaanbaatar in a logical way, with the last three digits matching the exchange code in the subscriber number (extended to three digits with 0 or 00 if necessary). They exclude 1818, which is a premium rate code, and many codes that do not correspond with exchange areas.

- The relations between the codes, charging and routing probably have many cases that make them difficult for service providers to manage and customers to understand.
- Codes used by MTC occupy a large part of the space. In some cases the full codes have four or five digits, but in others they have just three digits.
- There are several codes for calls to emergency assistance services and the police. However, 112, which in GSM networks is frequently used for calls to emergency assistance services, is not among them.
- There is no code for directory enquiries that will provide access from all access service providers to all networks and locations.
- The codes can be used to provide access to supplementary service features, though * can do this instead.
- Internet access services have codes beginning with 16. However, because they are dialled by computers (not humans), they could be given the longest possible number length to conserve numbers without affecting users. These internet access codes are mixed with two-stage international carrier selection codes.
- Premium rate services mainly have codes beginning with 19, but there are exceptions. Also, some internet access and VOIP services having codes beginning with 16 may be charged at premium rates.

Currently premium rate services are delivered using short codes that are:

- 1109, 188x and 19xx from fixed phones in Ulaanbaatar.
- 180x from fixed phones elsewhere (and also 1955 in Baganuur and 1978 in Tuv).

In addition, new co-ordinated ranges of six-digit codes for premium rate SMS and MMS (with one digit as a tariff indicator) are under discussion by the mobile operators.

10.4 Considerations for Mongolia

10.4.1 Availability of short codes

There are only 100 short codes in the range 1xx. New entrants to the market cannot be allocated as many codes as existing service providers. In fact there could easily be too many service providers to allocate a vacant 3-digit code to each. Considerations of equity and of long term convenience for users point to adopting a new policy whereby each service provider would have at most one 1xx short code, allocated exclusively to itself. For long distance service providers the codes would ideally be aligned with the carrier selection codes.

Service providers wanting to offer more than one service using this code would be able to use it with four or even five digits (though the use of five 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 national 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.)

If long term Option C of Section 5.3 is adopted, then the supply of short codes starting with 1 will be even more limited, to avoid conflicts with geographic numbers. Figure 16 shows that at least 24 of the theoretical 100 3-digit short codes would conflict with geographic numbers.

10.4.2 Routing for short codes

Customers would benefit from having common service codes for parallel use by all access service providers, with numerical identifiers for the service providers. For example, the single code 108 could be used by all access service providers 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 a simple short code, with manual onward routing**. The simple short code, such as 108, would be manually routed onward by the human service operator receiving a call to 108 on network B to connect the call through to network A.
- **Dialling a simple short code, with secondary dialling**. The simple short code, such as 108, would require secondary dialling of 75 in a call to 108 on network B to connect the call through to network A.
- **Dialling a compound short code**. The compound short code, such as 10875, would identify the nature of the call (a fault report) and network A.
- **Dialling a non-geographic national number**. The number, such as 8008 0075, would identify the nature of the call (a fault report) and network A. Part of the NDC 80 could be set aside for use in numbers at less than full national length (if desired).

For the time being, the first of these may be the most realistic, as it does not require much automation or numerical identifiers for access service providers. (These numerical identifiers should not be confused with the NDCs occupied by the access service providers, as these NDCs may be shared between service providers, especially if there is number portability.) It could in due course change to any of the other solutions.

10.4.3 Classification of short codes

As indicated in Section 10.2, short codes can be classified as follows according to whether they must be provided and how they must be interpreted:

- **Uniform meanings and compulsory availability in all networks and locations**. Short codes for essential services, such as emergency assistance, would be the same on all access networks and would be provided by all access networks. (This would also be expected for carrier selection codes, if all access networks had to allow their use) Such services might be provided separately in different networks and locations, with calls directed automatically to appropriate local service centres, but the services would be the same in all networks and locations.
- **Uniform meanings and optional availability in all networks and locations**. Short codes for common services, such as fault reports or directory enquiries (or, in some countries, “speaking clocks”), would be the same on all access networks but would not need to be provided by all access networks. (This would also be expected for carrier selection codes, if not all access networks had to allow their use.) Such services might be provided separately in different networks and locations, but the services would be similar in all networks and locations.
- **Separate meanings and optional availability in all networks and locations**. Short codes for commercial services, such as football results, would not need to be the same on all access networks and would not need to be provided by all access networks. Such services might be provided separately in different networks and locations.

Experience in other countries suggests that it is useful to have a classification of short codes and maintain a balance among the classes, so as to maximise customer convenience without stifling innovation. We suggest introducing such a classification in Mongolia and taking it into account in applications for new short codes. If a range is identified for the third type of code, then applications to be allocated short codes of this type become unnecessary: each service provider can just use the range as it sees fit.

10.4.4 Pricing for short codes

We suggest also the adoption of simple rules about the tariffs associated with short codes, so that different short codes with the same first two digits would have the same tariffs. They would generally also be in the same class according to the classification in Section 10.4.3: typically calls to short codes in the first class would be free and calls to short codes in the second class might be free (depending on the contracts between customers and access service providers).

10.4.5 Access to short codes

It is usual for the short code range 1xxx to be inaccessible using international dialling. We believe that this is currently the case in Mongolia, and we suggest that it should continue. In some countries, local information services (such as directory enquiries or weather) can be accessed using national dialling of a geographic NDC followed by the short code for that service. For example, in South Korea, directory enquiries (code 114) in Incheon (NDC 32) can be accessed from Seoul by dialling 032 114. Mongolia may want to consider such an arrangement for services in the first and second classes of Section 10.4.3.

There could be other problems of getting access to short codes. The following points illustrate why CRC has to ensure that short codes are used in ways consistent with the expected evolution of the national numbering plan:

- If different short codes are used for the same service in different locations on the fixed network, the usability and popularity of the service are reduced.
- If the same short code is used for different services in different locations on the fixed network, national availability of the services is impossible.
- The numbers 14xxxx and 15xxxx, originally suggested for premium rate MMS and SMS from mobile phones, are very similar to some national geographic numbers 14xxxx xxx and 15xxxx xxx. This could be confusing. The problem is that the premium rate numbers are distinguished from the national geographic numbers mainly by their lengths
- These numbers 14xxxx and 15xxxx are also similar to some short codes 14x and 15x that are used on fixed phones to activate and deactivate supplementary services. This would add to the confusion, if mobile phones activate and deactivate supplementary services in the same way as fixed phones.
- The use of 21x and 22x (instead of local numbers in the ranges 21xxxx and 22xxxx) for the MTC prepaid service in Ulaanbaatar is irregular. It undermines any efforts to keep short codes in a single range, and may create services on apparently national numbers that are not actually available throughout Mongolia. However, these codes were probably chosen in imitation of the use of similar codes for the Mobicom prepaid service, and as such are an example of inter-operator harmonisation.

10.4.6 Allocation of short codes

The consistent use of short codes by all mobile service providers is in the interests of customers and value added service providers: for each value added service a single number can be advertised to all end users and should work on all networks. The management of short codes could be left entirely to the mobile service providers, with no intervention by CRC. However, doing this could lead to some of the following problems:

- **Discrimination in network access against third party value added service providers**. Mobile access service providers 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.
- **Limited harmonisation between networks**. Customers might need to use different short codes on different networks for the same value added services. Value added service providers might be unable to brand their services simply or to port numbers between networks (because of possible conflicts).
- **Inadequate protection for consumers**. The tariff and content might not be indicated by the numbers or controlled in any other way.

We therefore suggest that CRC should work with the industry group that has been set up to introduce new codes for premium rate SMS and MMS, to ensure that there are no problems like these. Structuring such codes is discussed in Section 9.4.

10.4.7 Choices of emergency assistance short codes

There are already various emergency assistance numbers for specific services. If there were one number for all assistance organisations (fire, police, ambulance and so on) there would also need to be operational arrangements so that the recipients of calls on that number could contact the right assistance organisations.

If there were one number for all assistance organisations, it might be 112 (to match practice in the EU and in many GSM networks) or 119 (to match practice in Japan and South Korea). However, 112 is not currently available. Also, we prefer to avoid creating short codes in the 11x range, to make it easier to remove the national prefix 0.

We suggest therefore that no more emergency assistance numbers should be introduced. They might simply create confusion. Instead, the operational arrangements for one or more of the existing numbers should be enhanced so that the recipients of calls can forward calls to the other numbers. In due course, these other numbers might be withdrawn[76].

10.4.8 Choices of directory enquiry short codes

Having directory enquiry services cover all networks and locations would benefit users. We therefore suggest that CRC introduce a directory enquiry number that is to be available for all networks and locations. (However, calls to this directory enquiry number might be routed to different directory enquiry service providers, depending on the access service providers of the callers.)

If international harmonisation were desired, the number might be 118 (to match practice in the EU), 104 (to match practice in Japan) or 119 (to match practice in South Korea). However, international harmonisation of short codes for directory enquiry services is useful only where the language is well enough understood that foreign visitors are likely to make directory enquiry calls. We do not regard it as a priority in the current situation.

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[76] Experience in Poland and other countries in the EU suggests that individual numbers for different assistance organisations may be kept even when there is one number that serves all the organisations.

We suggest instead that the short code 109 be used for directory enquiry services. There would not necessarily be an obligation to provide directory enquiry services; there would be an obligation to use 109 for them if they are provided[77].

In addition, we suggest reserving a range of short codes, such as 108xx, in case competition between directory enquiry service providers is introduced. However, we do not advocate introducing this form of competition. It has not proved very satisfactory in some countries[78]. Also, with the split between servcos and netcos, access service providers should provide competing directory enquiry services anyway.

10.4.9 The split between netcos and servcos

The classification of short codes discussed in Section 10.4.3 deals with whether codes are have uniform meanings and are available for all networks. However, recipients of these codes present the public images of companies to end users. They are therefore acting on behalf of servcos (in particular, the access service providers of the end users), not netcos.

There are likely to be short codes that have uniform meanings for all servcos but that represent call destinations which depend on the servco. Directory enquiry numbers, as identified in Section 10.4.8, are among them, at least if different servcos can have different directory enquiry service providers.

When different callers have different servcos, the networks must be able to route their calls to different destinations, even when the calls are made to the same short code. Call routing is therefore dependent on predefined caller preferences. In this respect, when there is a split between netcos and servcos, implementing short codes is as difficult as implementing carrier preselection. It is not so difficult when there is no split between netcos and servcos.

10.5 Recommendations for Mongolia

We recommend that CRC, with the industry working group, replan short codes using the following guidelines:

1. Requesting from all service providers figures for the utilisation of each short code.
2. Imposing strict requirements (such as essential relevance to safety, minimum levels of utilisation, uses related to telecommunications or uses unsuitable for just national numbers) to justify obtaining or retaining short codes.
3. Raising charges for short codes, at least when service providers want more than one.

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[77] Keeping directories comprehensive and up-to-date is difficult: prepaid service customers, in particular, may switch between numbers on different phones. Because of this, in some countries, there is no attempt to keep mobile numbers in directories. The terms and conditions under which customers get numbers should say explicitly whether the numbers will or will not be included in directories unless the customers request the opposite. Then directories would include those numbers that customers had authorised for inclusion and that service providers could keep up-to-date.

[78] In the UK, for example, competition between directory enquiry service providers was introduced after careful investigations but is acknowledged to have led to higher prices and lower quality. Various other countries in the EU have had similarly experiences (possibly because the overall market for directory enquiry services is declining, owing to the internet). If competition between directory enquiry service providers is ever introduced in Mongolia there will be awkward questions to answer about which, if any, service provider is entitled to answer calls to the existing, familiar, directory enquiry number or to the more pleasing new numbers, such as 10888.

4. Requiring that certain short codes have the same interpretations for all networks and locations and that the provision of these short codes be mandatory in some cases (such as for emergency assistance services) and optional in other cases (such as for directory enquiry services).
5. Minimising conflict between short codes and geographic numbers if long term Option C is to remain open.
6. Reserving a range of short codes for use if there are ever to be competing directory enquiry service providers.
7. Requiring that all numbers conform with applicable regulations about tariff ceilings and access from other networks and locations.
8. Consulting the industry and consumer groups about the short code structure, dealing with, in particular:
    - Whether having at most one 1xx code per service provider would be feasible.
    - Which other short codes should be used for which purposes in a new structure for short codes.
    - Which short codes should be in a set of common service codes for parallel use by all fixed and mobile access service providers.
    - What other harmonisation between short codes on fixed and mobile phones (including those using * and #) would be feasible.
9. Monitoring the development of USSD short codes to determine whether they should be subject to the same regulation as SMS and MMS short codes.
10. Encouraging or requiring migration of premium rate services from short codes to full length national numbers starting with 90. For example, the current code 1923 might migrate to 9000 1923.
11. Encouraging or requiring migration of internet access codes from short codes to appropriately tariffed full length national numbers.
12. Opening special ranges of appropriately tariffed national numbers (possibly at less than full national number length) for value-added SMS and MMS. These could, for example, be 907 xxx, 908 xxx, 909 xxx (with 7, 8 and 9 as tariff band indicators).

11 Allocation of numbers

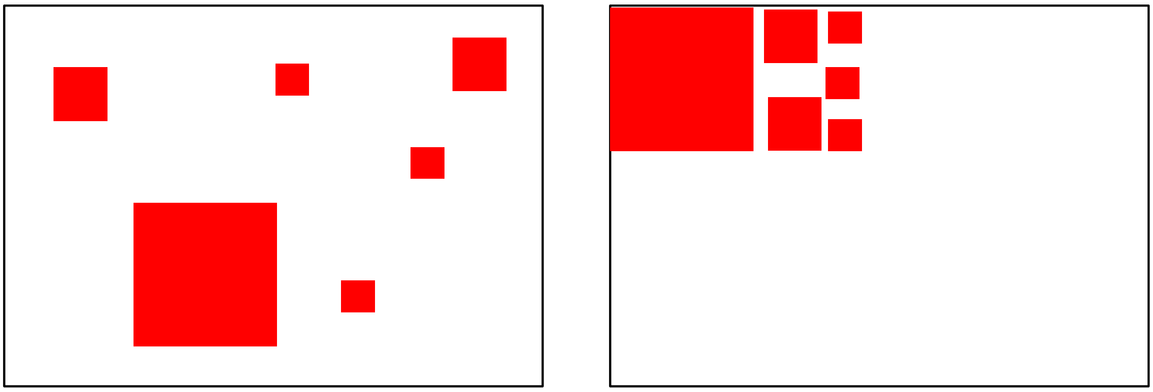
CRC has the job of allocating numbers efficiently and fairly. Efficiency in number allocation (illustrated in Figure 17) depends on:

- the sizes of allocated number blocks and the utilisation required by service providers, which are discussed in 11.1.1;
- the choice of number blocks for allocation, discussed in 11.1.2.

Fairness in number allocation is affected by:

- the treatment of memorable numbers, discussed in 11.1.3;
- the processes for distributing numbers, discussed in 11.1.4.

Section 11.1.5 looks at the implications of the netco/servco split for number allocation.



A B

Figure 17 Inefficient (A) and efficient (B) number allocation

11.1 Considerations for Mongolia

11.1.1 Sizes of allocations of numbers

Fixed numbers in Mongolia have been allocated (or at least adopted by service providers) in blocks ranging in size between 100 and 10,000 numbers. For VOIP service providers 1,000 numbers may be enough for initial trials or minor deployments. The existing number holdings ought to be well utilised before further allocations are granted. A figure of 60% utilisation is often appropriate to geographic numbers but lower figures may be needed sometimes (because of splits between exchanges or reasonable reservations for Direct Dialling In, for example)[79].

Mobile numbers in Mongolia have been allocated in blocks of 1 million and **WLL numbers** initially in blocks of 100,000 within reserved blocks of 1 million. Most service providers do not need a million number block; for them, blocks of 10,000 or 100,000 numbers ought to be adequate (with reasonable reservations of contiguous numbers to allow for foreseeable

[79] 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%.

growth)[80]. Allocating such smaller blocks would not only conserve numbers but also discourage service providers from using the 2-digit NDCs when branding their services; branding services in this way is unwise and inappropriate, because service provider number portability may be introduced. The utilisation is likely to be limited by the need to recover unused but allocated numbers for prepaid services and perhaps by the wish to provide memorable numbers to customers.

For **specially tariffed numbers** other than short codes, lower levels of utilisation may be suitable, because those information services that aim to have mass markets will seek memorable numbers (though other information services will not do so). Probably there are at most 50,000 memorable numbers for each non-geographic 8-digit number range[81].

For **short codes**, the utilisation is likely to be high, because supplies are limited.

Requiring justifications in applications for allocations, and withdrawing unused allocations, will usually 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 number space unnecessarily or creating artificial shortages for competitors.

ITU recommendation E.164 specifies that seven digits of the international subscriber number, including the country code, should be enough to determine the international gateway exchange to which calls are routed in the destination country. In Mongolia at present this indicates that each number in a block of 10,000 (8-digit) numbers receives international calls through the same international gateway exchange (presumably associated with a particular domestic network), or that the gateway will reroute calls destined for other domestic networks. Particularly in the light of the merging of Fixed Network Identification Codes and possible new market entry, service providers will need to confirm their arrangements for receiving international calls on each numbering block.

11.1.2 Structure for allocations of numbers

Allocating number blocks next to each other helps to avoid inefficient fragmentation of number space. (For instance, fragmentation is avoided if the block 877x xxxx must be allocated before the block 878x xxxx.)

Allocating number blocks out of sequence produces possibilities for real or perceived discrimination and tends to fragment number space. If number blocks are allocated out of sequence the allocations should be made through a process that is demonstrably fair. Examples of such processes (for handling applications for allocations of number blocks out of sequence) include:

- First-come-first-served selections in which the applications for allocations have recorded delivery times.
- Lotteries in which the applications for allocations are opened, and entered into lotteries, at planned public meetings of the regulator.

To limit further fragmentation the process could incorporate rules about which such number blocks could be allocated out of sequence. These rules might state, for example, that a block

[80] There are approximately 45,000 customers using WLL phones, but 6 million numbers have been set aside for WLL networks.

[81] For example, a block of 1 million numbers contains 1,100 numbers having two identical 3-digit groups or three identical 2-digit groups (such as 80 111 222 or 80 11 22 33).

of 10^m numbers could only be allocated out of sequence if a block of 10^m numbers had already been allocated from the smallest enclosing block of 10^{m+1} numbers. (For instance, the block 8785 xxxx could be available for allocation out of sequence only if another block in the 878x xxxx range had already been allocated.) In Mongolia, such rules are difficult to apply currently, because:

- The existing principles for allocating fixed numbers (according to aimag centre codes, soum centre codes and exchange codes) create a “fine structure” for geographic numbers. .
- The existing allocations of mobile numbers are very large, and the new allocations of WLL numbers are far apart.

In fact, even with careful control of utilisations, number shortages may develop. Ways of expanding the supplies of numbers by extending numbers should ideally be incorporated in every NDC. For example, if all numbers in the range 897x xxxx are spare, then the NDC 89 can be given 10 times as many numbers as it had, by first inserting 7 as a new third digit in each existing number in the range 89xx xxxx (to move it to the range 897xx xxxx) and then allowing digits other than 7 as the third digit in numbers.

11.1.3 Treatment of memorable numbers

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 number range; for example, the block of 10,000 numbers that begins at 8000 0000 may be more desirable than the block that begins at 8074 0000. This difference in desirability may lead regulators to consider not allocating number blocks that begin at memorable numbers, such as 8000 0000 or 8080 0000.

However, more significant than the desirability of a number block is the ease of memorising an individual number or 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. In such circumstances there is a case for not allocating memorable numbers, or for introducing a fair process, such as those discussed in the next section, into their allocation.

In deciding whether and how to allocate memorable number blocks, CRC has to weigh the loss to the public of not allocating them against the advantages to the organisations that would be allocated them.

11.1.4 Fair processes for distributing numbers

Individual numbers (or indeed whole number blocks) might be allocated through various processes. These processes are mentioned in Section 6.4 in the context of carrier selection codes, but they can also be applied to national numbers and short codes. Different allocation processes may be appropriate in different circumstances and for different number types. In particular:

- Potential number holders may choose their numbers if there is no concern about the advantages obtained by holding them. (This might be because the numbers available for allocation are approximately equally memorable.)
- Beauty contests are perhaps best turned into requirements for qualifying for entry to other contests 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 national 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)[82].

- Lotteries of numbers may be held if there is no concern about the advantages obtained by holding them. (This again might be because the numbers available for allocation are approximately equally memorable.)

There are personal and cultural differences in which numbers are regarded as memorable or "golden". The cultural differences (such as whether the digit 7 is lucky or unlucky) can be codified[83].

11.1.5 The split between netcos and servcos

Users are assigned numbers by servcos, not netcos; netcos do not have direct relations with retail customers. By this argument, numbers should be allocated only to servcos, not netcos. However, if numbers are allocated to netcos, service provider number portability (defined as in Section 14.1.1) can be automatic between servcos that take service from the same netco. Also, the current national numbers already imply allocations of numbers to different networks.

There is therefore an important question of which providers should receive or make allocations. When discussing this, we say that:

- A primary allocation is an allocation of numbers by the regulator to a network or service provider that is eligible to have such an allocation.

- A secondary allocation (sometimes called a 'sub-allocation') is an allocation of numbers by a network or service provider to another network or service provider.

There are various circumstances in which secondary allocations might be more economical or convenient than primary allocations. For example:

- Resellers such as Mobile Virtual Network Operators (MVNOs) in various countries use secondary allocations from their providers of network facilities, because they can combine applications for numbers with other negotiations with the providers. In Mongolia MVNOs (if introduced) are likely to be servcos (though, once established, they might also wish to have some network facilities of their own, to reduce costs or improve service)[84].

- 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

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[82] 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.

[83] For example, in Singapore, each block of 10,000 numbers is regarded as containing 486 "golden" numbers. The "golden" numbers are 10 having four occurrences of one given digit, 180 others having three adjacent occurrences of one given digit, 270 others having two occurrences of each of two given digits, 16 others having three 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. See *National Numbering Plan* (IDA, August 2006) at http://www.ida.gov.sg/idaweb/ doc/download/I476/National_Numbering_Plan_Aug_06_2.pdf.

[84] One problem with drawing a regulatory distinction between netcos and servcos is that it inhibits investment in networks by servcos.

administrative burden on regulators is reduced if such numbers come from existing primary allocations.

- Large businesses want their own number ranges, which in many countries are allocated by service providers, not the regulators, even if service provider number portability has been introduced. (However, large businesses are typically regarded as users, not service providers, so this is not strictly an example of secondary allocation.) Corporate numbers, as described in Section 9.1, are allocated by the regulators but are fairly unusual.

The network or service providers that are eligible for having primary allocations of numbers could be chosen in various ways. (For instance, they could be the network or service providers able to justify requests for blocks of 10,000 or more numbers.)

The choice to be made here is largely one of making (primary and secondary) allocations economical and convenient. Though servcos are the organisations that assign numbers to users, there may be some gains in economy and convenience if CRC makes primary allocations to netcos, which make secondary allocations to servcos. This point will be in doubt until the proposed industry structure becomes clear.

CRC must monitor and control the use of secondary allocations as well as primary allocations. Obligations on network and service providers that achieve this are among those given in Section 13.1.1.

11.2 Recommendations for Mongolia

We recommend:

1. Issuing explicit rules about the utilisations expected in existing allocations of numbers blocks before new allocations will be made.
2. Withdrawing portions of existing allocations of numbers where the service providers have not used them and do not have good expectations of using them soon.
3. Identifying potentially memorable numbers, taking into account the cultural factors specific to Mongolia.
4. Introducing demonstrably fair allocation processes for potentially memorable numbers.
5. Reserving for each NDC the numbers that have a particular third digit (for 2-digit NDCs), which is chosen as consistently as possible for all NDCs, to allow for possible future extensions to the numbers for that NDC.
6. Reviewing trends in demands for numbers annually.
7. Exploring with the industry which organisations should be eligible for primary allocations and which organisations should be eligible for secondary allocations.
8. Imposing requirements on allocations that apply to secondary allocations as well as to primary allocations.

12 Charging for numbers

CRC especially requested proposals for number charges in Mongolia. This section outlines how numbers are charged for in the minority of countries that have such a system. It proposes principles that could underlie charging for numbers in Mongolia, and tentatively puts forward a possible set of charges that could fulfil the objectives of CRC.

12.1 Experience in other countries

Charging for initial allocation and continuing use of numbers is often regarded as a useful way of encouraging care in using numbers. However, in the majority of countries it is not done, mainly because:

- There is an administrative cost involved in collecting charges, which may be disproportionate to the benefits obtained.
- Charges for numbers may be perceived as unfair because the use of numbers has already been paid for another way, for example through charging for licences.

Factors that may be taken into account in setting charges for numbers include:

- The actual costs involved in managing numbers. Law in the EU, for example, says that in general only such costs may be recovered through charges for numbers.
- Revenue requirements of the regulatory authority. In some countries, charges for numbers (and often also for spectrum) are a major source of income for regulators (in which case licence charges, for example, should be correspondingly low).
- In cases of number scarcity, costs of expanding the number supply.
- The level of charge that will create an incentive for service providers to use allocations with care, return unused numbers, and apply for new numbers only when necessary.
- The inherent value of the memorable numbers included in an allocation.

International practice in charging for numbers varies very greatly[85]. For example:

- In some countries, such as Australia, Denmark and Saudi Arabia, there are usage charges that vary with the length of the numbers in the allocation. (For instance, an allocation of 5-digit numbers would occupy 10,000 times as much number space as an allocation of 9-digit numbers, so its usage charge would be 10,000 times as high.)
- In other countries, such as Tanzania, the main aim is to pay for number administration.
- In Singapore the charges for an allocation of 10,000 numbers are intended to relate to the 486 "golden" numbers.

In some countries, numbers with pleasing patterns (such as 8080 8080 or 1234 5678) are so highly valued that special systems have been devised for their sale or auction. Such arrangements work best alongside number portability, because:

- Number portability enables someone who has paid a lot for a number to keep it while benefiting from competition by changing service provider.

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[85] For a survey of practices on charging for numbers see *Numbering Survey* at http://www.itu.int/ITU/inr/misc/files/bdt_numbsurvey-en.doc. In the survey 39 countries (including 19 in Europe) have charges and 48 do not.

- Portability makes number trading a much more attractive prospect, as without number portability someone who buys a number is tied to using it on the same network and often at the same termination point as the seller.
- Portability often relies on database technology of a similar kind to that used for individual number administration.

12.2 The current position in Mongolia

Currently number allocations are free of charge in Mongolia, except that:

- Each network identification code has a charge of 0.001% of national long distance call revenues[86].
- Each international carrier selection code has a charge of ₮50 million in the first year and 0.19% of international call revenues in later years[87].
- Each 16xx short code has an annual charge of ₮200,000.
- Each short code used for customer service or technical purposes has an annual charge of ₮50,000.
- Each premium rate short code has an annual charge of ₮500,000.

Available discounts are:

- 50% off special number charges used for directory information service in aimag centres.
- 80% off special number charges used for directory information service in soum centres.
- 10% off special number charges from the third year in which the service provider has been offering the service.

12.3 Considerations for Mongolia

By looking at staff functions, the EBRD regulatory support project has concluded that numbering charges should cover at least 3% of the total annual costs of CRC (or approximately ₮30,000,000). CRC has asked us to propose different charges from the current ones. Before doing this we note the following other possibilities:

- Extending the current scheme to take into account the proposed changes to the numbering plan.
- Eliminating numbering charges by recovering the costs of number management through licence fees.

If there are to be different charges, then, building on Section 12.1, we suggest that they be designed to accommodate, where possible, the following principles:

- They should recover the costs of managing numbers only if the administrative costs involved in collecting charges are not disproportionate.
- They should serve purposes that are clearly distinguished from those served by other fees levied by CRC, such as licence fees.

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[86] We understand from CRC that this revenue-based charge has not in fact been made, although it is in the regulation on regulatory fees.

[87] We understand from CRC that this revenue-based charge has not in fact been made, although it is in the regulation on regulatory fees.

- They should recognise that the costs involved in allocating individual numbers are higher per number than the costs involved in allocating large blocks of numbers.
- They should recognise the higher than average costs per number of regulating premium rate services.
- They should provide incentives to service providers to apply for allocations only when necessary, use allocations with care and return unused allocations[88].
- They should reflect the relative costs and likelihoods of expanding the number supply for different kinds of numbers, so they take into account both supply and demand.
- They should be the same for numbers for different services that could be seen as substitutes for one another, so they do not discriminate between technologies.
- They should be the same for numbers in different ranges for the same service, so they do not make assumptions about how memorable numbers are within ranges.

These principles are not always consistent with one another. Nonetheless, they help with explaining charges and can usefully be published along with the charges themselves.

CRC might distinguish between a flat rate administrative and a usage charge that reflected the size of the number block allocated. The administrative charge might be low, to encourage service providers to ask for no more numbers than they need in a given application. The usage charge would depend on the strength of the incentive to be given to service providers and on the extent to which services using the number block needed regulation.

One scheme that covers the relevant annual costs of CRC and is compatible with these principles is as follows:

- Each block of 10,000 geographic numbers has an annual charge of Ŧ100,000. (This is applicable after network identification codes have been replaced by the digit meaning “geographic numbering”.)
- Each block of 10,000 non-geographic numbers other than numbers for information services at special tariffs has an annual charge of Ŧ100,000.
- Each block of 100 numbers for information services at special tariffs has an annual charge of Ŧ1,000 if the recipients of calls do not benefit financially. (This is applicable if freephone services use full length numbers beginning with 80.)
- Each block of 100 numbers for information services at special tariffs has an annual charge of Ŧ200,000 if the recipients of calls benefit financially. (This is applicable if premium rate services use full length numbers beginning with 90.)
- Each short code of the form 1xx has an annual charge of Ŧ1,000,000, with longer short codes having proportionately lower charges (so short codes of the forms 1xxx, 1xxxx and 1xxxxx have annual charges of Ŧ100,000, Ŧ10,000 and Ŧ1,000 respectively) if the recipients of calls do not benefit financially.
- Each short code of the form 1xx has an annual charge of Ŧ200,000,000, with longer short codes having proportionately lower charges (so short codes of the forms 1xxx, 1xxxx and 1xxxxx have annual charges of Ŧ20,000,000, Ŧ2,000,000 and Ŧ200,000 respectively) if the recipients of calls benefit financially.

[88] An alternative to imposing charges that encourage high utilisation is imposing penalties for low utilisation. Doing this might appear to involve less regulation; in fact, however, it might involve more regulation, as extra effort would be spent on checking the utilisations claimed by service providers. As there is a prior budgetary requirement for charges for numbers we do not pursue this alternative further here.

- Each carrier selection code of the form 00x has an annual charge of ₮10,000,000.

As it stands, this scheme ignores the administrative cost of making the allocation: essentially its charge for a block containing 100 specially tariffed numbers is the same as its charge for 100 specially tariffed short codes having the same length. However, if many numbers are to be allocated individually, the administrative cost should not be ignored. The scheme above might then be modified so that, for example, there was an administrative charge of ₮50,000 for each allocation (and corresponding reductions in the usage charge for fixed, WLL and mobile numbers at least).

Numbering charges have little merit unless they provide significant and necessary incentives to service providers. Possibly even with the scheme described above the incentive to service providers remains too small to justify having the charges.

Number charges could be used to help manage a transition in carrier selection codes, such as is discussed in Section 6. For example, if the objective is to encourage existing holders of 00x codes to migrate voluntarily to new codes, then the annual charge for 00x codes could be raised each year. Or if the objective is to limit demand for new 00x codes, then the charges for all 00x codes could be higher if there are fewer of them left unused[89].

We suggest that CRC does not auction numbers and that service providers do not auction numbers for which there is no service provider number portability. However, there should be no obstacle to service providers making moderate charges to end users for being able to choose their own numbers for services, within the constraints of good husbandry. Service providers should tell end users that payments for number allocations provide only rights of use subject to the national numbering plan and should state what compensation is payable if number allocations are revoked.

To keep the management of numbers simple, number trading might be prohibited for some years. However, unless there is service provider number portability, trading opportunities are so limited that there is little need for an explicit prohibition. Furthermore, if someone does want to buy an active number (typically as part of a going business concern) we see neither any reason to prevent the transaction, nor any good way to do so (as the number is only one part of a larger sale).

12.4 Recommendations for Mongolia

We recommend:

1. Designing charges according to clear principles.
2. Publishing an explanation of the principles along with the charges.
3. Avoiding auctions of, and trading in, individual numbers in NDCs that do not offer service provider number portability.
4. Using number charges to support whatever decision is made on the future of carrier selection codes.

[89] For example, annual charges could be set at ₮40 million divided by n, or at ₮10 million times (5-n), where n is the number of codes remaining.

13 Conditions on the use of numbers

CRC requested a code of practice for network operators when they use numbers. This section provides the likely content for such a code of practice. For clarity, we propose that its status should be part of the numbering regulation rather than a separate document.

13.1 Considerations for Mongolia

13.1.1 Obligations on, and rights of, allocation holders

All allocations of numbers impose certain obligations and confer certain rights. These obligations and rights can be laid down in a code of practice or some other instrument.

Having paid for a number, especially a memorable number, strengthens the presumption of having rights over it[90]. However, numbers themselves remain the property of the country as a whole, with CRC as custodian. What can be allocated (and in principle could be transferred or traded) is the right to use numbers for specific purposes for the time being.

Usual obligations on an allocation holder are:

- To allocate numbers only for purposes permitted in the conditions of use laid down by CRC. These conditions may be specific to particular numbers (for example, for tariff transparency and content control, which are especially relevant for premium rate services) and may change from time to time.
- To avoid claiming, or trying to create, rights in a name containing numbers in allocations, unless the numbers are short codes with interpretations that are allowed to be different in different networks. Numbers should not be used for branding purposes (as opposed to other marketing purposes) as they might be withdrawn or ported.
- To bring numbers in allocations into service within six months of receiving the allocation (or such other period as CRC may permit).
- To maintain full records of numbers in use (in categories such as ‘in service’, ‘in quarantine’, ‘for withdrawal’, ‘unsuitable’ and ‘available’).
- To pay fees for any primary allocations as prescribed by CRC.
- To remain responsible for any primary allocations even after making secondary allocations or assigning numbers to end users.
- To make secondary allocations from existing allocations allocation fairly and speedily, after receiving justified applications for them, unless following due process CRC determines that the applicant shows a prior pattern of failing to fulfil the obligations on allocation holders.
- To report annually to CRC on the current and predicted utilisation of primary allocations (and therefore of the secondary allocations made from those primary allocations) at whatever level of granularity[91] CRC finds useful.

[90] This argument holds special force in the US, where for years it has delayed the introduction of number charges.

[91] Information at the level of individual numbers may be too detailed – it changes fast and is a nuisance to collect. But information at the 1 million block level is unlikely to be detailed enough. CRC should consult the industry on what reporting level is both practicable and useful for all concerned.

- To return allocations to the organisation that made the allocations if the services using the allocations are withdrawn from all customers.
- To inform recipients of secondary allocations about the obligations on allocation holders.
- To inform end users to whom it assigns numbers about their obligations and rights. The rights should include those identified in Section 13.1.3.
- To withhold numbers from re-assignment to end users during quarantine periods. These quarantine periods are usually between three and nine months, to allow for calls to the original number user to die down.

Usual rights of an allocation holder are:

- To receive allocations after submitting justified applications for them, unless following due process CRC determines that there is a prior pattern of the applicant failing to fulfil the obligations on allocation holders.
- To continue to use allocations while they are needed, unless following due process CRC determines that parts of the allocations should be withdrawn for a good reason (because they are being used for purposes that violate the conditions of use, they are not being used, or they are needed for other purposes in the national numbering plan).
- To receive from the organisation that made the allocations advance notice of withdrawal of parts of the allocations, if they are not being used or they are to be used for other purposes that advance the national interest.

13.1.2 Obligations on, and rights of, network and service providers

Numbering affects network and service providers even if they are not allocation holders.

Usual obligations on a network or service provider are:

- To make secondary allocations or assign numbers to end users only from existing allocations made to the network or service provider.
- To make all reasonable endeavours to route calls to numbers, unless CRC instructs otherwise or the numbers are short codes with interpretations that are allowed to be different in different networks, when the network or service provider may provide announcements or tones agreed with CRC[92].
- To transmit numbers completely and correctly when routing calls[93].
- To take speedy action (such as blocking calls, withholding payments, or withdrawing secondary allocations) if CRC determines that numbers are being used for purposes that violate the conditions of use.

Usual rights of a network or service provider are:

- To receive from an allocation holder advance notice that calls should be routed to numbers.

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[92] As it stands, when freephone and other specially tariffed services are introduced this clause places power in the hands of those network providers that offer number translation services. If two or more national network providers offer such services this may not be a problem. Otherwise the regulator will need to regulate rigorously the prices and interconnection arrangements for number translation services.

[93] This clause is needed only up to those points in the networks where there would be financial or legal implications in transmitting incomplete or incorrect CLIs (such as failure to pay correct interconnection rates or inability to perform lawful interception).

13.1.3 Obligations on, and rights of, end users

The obligations on end users related to numbering are rarely distinguished from the obligations related to receipt of service, and are generally included in their service contracts.

Usual obligations on an end user are:

- To use numbers only for purposes permitted in the conditions of use laid down by CRC.
- To pay the amounts due under service contracts or risk disconnection.
- Not to break the law through the use of the number and service.
- Not to send a misleading ‘presentation CLI‘ (a number sent to call recipients instead of the phone number, or Calling Line Identifier, of the caller).

Usual rights of an end user are:

- To receive assignments after submitting justified applications for them, unless following due process CRC determines that there is a prior pattern of the applicant failing to fulfil the obligations on end users.
- To continue to use numbers while there are valid service contracts, unless following due process CRC determines that the numbers should be withdrawn, because they are being used for purposes that violate the conditions of use or they are to be used for other purposes in the national numbering plan.
- To receive from the allocation holder advance notice of withdrawal of numbers if they are to be used for other purposes in the national numbering plan. This notice should be at least six months for business customers and three months for residential customers.
- To have disruption due to withdrawal of numbers minimised if they are to be used for other purposes in the national numbering plan. There might, for example, be free-of-charge changed number announcements for at least a month after the withdrawal.
- To be assigned numbers that do not receive many misdialled calls, and, if receiving a troublesome level of misdialled or nuisance calls, to change numbers free of charge.
- To know whether numbers are routinely included in a recognised public directory; and, if included, to have correct and up-to-date entries submitted speedily and free of charge by the network or service provider.
- To know whether CLIs are routinely sent to call recipients (not just into the network), and any options that are available to callers for changing this[94]. These options might involve, for example, call-by-call or permanent suppression of CLI sending.
- To port numbers speedily to another provider of any other service for which the number is appropriate according to the numbering plan, if following due process CRC has determined that service provider number portability should be available for the numbers in question.

[94] Service providers may find difficulty in providing CLIs to called parties. Problems can arise, for example, with calls that travel across VPNs, use call-by-call selection or use two-stage dialling. For reasons of privacy callers should be able to suppress sending of CLIs, so CLIs offer little protection against malicious calls. We therefore do not propose that service providers be obliged to provide CLIs to called parties.

13.2 Recommendations for Mongolia

Many of the obligations and rights just outlined are already stated in or implied by the *Procedure on the Provision of Numbering to the Telecommunications Network*. We recommend:

1. Codifying the obligations and rights, by extending the Procedure on the Provision of Numbering to the Telecommunications Network or otherwise.

14 Number portability

Number portability is a big subject. When it is a live issue in a country, it warrants a whole report on its own. This section aims only to provide a short overview of the most important features, and to explain why Mongolia may not want to implement number portability for a few years yet.

14.1 General aspects

14.1.1 Forms of number portability

Figure 18 illustrates the following forms of number portability:

- **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 that do not differentiate between services can be portable between 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 while to another customer it offers text and video as well. Even without IP, customers may change their services between fixed access, converged fixed-mobile access, and mobile access and want to keep the same number. Service number portability is therefore assisted by not using numbers 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 by not using numbers 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 numbers to tariff floors (as opposed to tariff ceilings). Service provider number portability is the form of number portability that creates most interest, because of its potential for stimulating competition.

L: Location number portability lets customer B change from occupying location 1 to occupying location 2 without changing phone numbers.
S: Service number portability lets customer B change from taking service 1 to taking service 2 without changing phone numbers.
P: Service provider number portability lets customer B change from being connected to access network 1 to being connected to access network 2 without changing phone numbers.

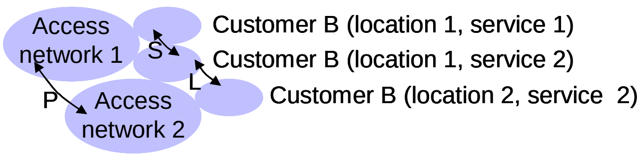

Figure 18 The three main forms of number portability

For the purposes of this report the most important form of number portability is service provider number portability. Figure 19 displays the distinctions between carrier selection (which facilitates competition in access networks) and service provider number portability (which facilitates competition in trunk networks).

CS: Carrier selection lets customer A change
from making calls through trunk network 1
to making calls through trunk network 2
without changing access networks.
NP: Service provider number portability lets customer B change
from being connected to access network 1
to being connected to access network 2
without changing phone numbers.

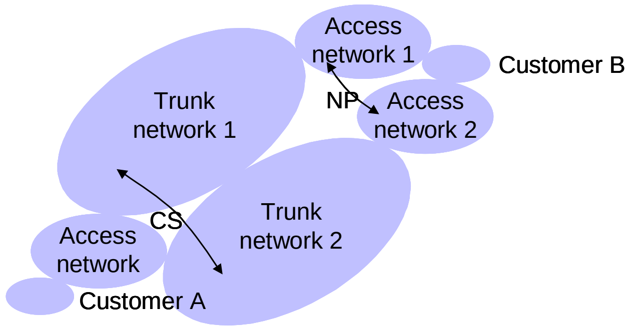

Figure 19 Carrier selection and service provider number portability

Though service provider number portability is assisted from the point of view of customer perception by not using numbers to differentiate between services, it might also be made more difficult to implement, because services with very different implementations might occupy the same number range. In principle one number range might be used by VOIP networks, traditional fixed access networks and mobile access networks. Interworking of signalling and voice channels between these different networks is already required for satisfactory interconnection. Service provider number portability adds the need to ensure compatibility between its implementations in the different networks.

14.1.2 Implementations of number portability

Figure 20 shows examples of the following 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. Figure 20 illustrates All Call Query schematically for fixed networks (though WLL and mobile networks might choose similar implementations).
- **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 an evolution from call forwarding implementations), Query On Release and Call Dropback or Return To Pivot. Figure 20 illustrates Onward Routing schematically for mobile networks.

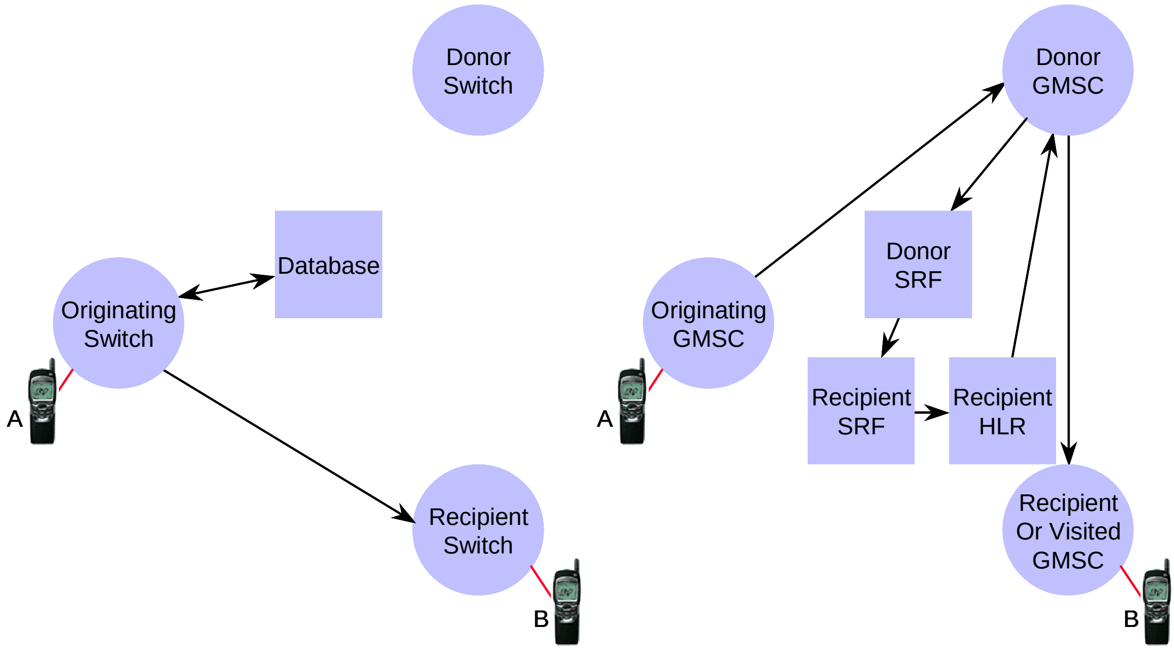

Figure 20 Two-network and three-network implementations of service provider number portability

Figure 20 makes a two-network implementation look much simpler than a three-network implementation. In reality, however, 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 service providers 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 two-network implementation[95]. Even the cheaper implementations have costs[96].

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 for GSM often use Signalling Relay Functions (SRFs) and Home

[95] 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.

[96] 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.

Location Registers (HLRs) that are not available in fixed networks[97]. 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 service providers and therefore that the implementations are the same for different service providers.

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. 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 number translation and routing mechanisms that conflicted with ENUM, while 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 number ranges 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.

14.2 Experience in other countries

Service provider number portability is often regarded as a good way of stimulating competition. Fro example, 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%.

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[97] 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 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 HLRs even when they do not have service provider number portability they are sometimes able to provide service provider number portability without significant upgrades.

The cases of Hong Kong and Finland are the ones where number portability is usually said to have stimulated competition. Unfortunately, there are also countries where number portability has not had the strong effects that were predicted. This is so, for example, in Singapore, Taiwan and Australia: there 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, but this did not in fact happen.

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[98]. 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.

A current informed European view on number portability is well summarised by the following extract from an official report[99]:

> The issues around number portability have changed over the last decade in a paradoxical manner:
>
> - Number portability requirements have become much more common and are regarded in the European Framework as a user right irrespective of the cost, yet the set-up cost in some smaller countries (eg of less than 1 million subscribers) may be as high as 30 Euros per subscriber (over all subscribers, not per just porting subscribers).
> - The problems of changing number have reduced especially for individual subscribers, and so the net benefit of number portability has reduced, because most subscribers can easily inform their correspondents of a change in number via a broadcast email at zero marginal cost.
>
> Where number portability has not yet been introduced, NRAs should ensure that the prospective benefits outweigh the costs and that the problems of changing operator cannot be alleviated adequately by other cheaper solutions.

14.3 The current position in Mongolia

Currently there is no number portability in Mongolia. Inevitably questions are being asked about whether, and if so when, it should be introduced

[98] 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.

[99] Extract from ECC report 087, The Future of E.164 Numbering Plans and Allocation Arrangements, Lisbon, September 2006

14.4 Considerations for Mongolia

14.4.1 Potential effectiveness

Service provider number portability can be expensive to implement and be ineffective in increasing competition greatly. Some factors appear to contribute to its effectiveness. Among them are the following:

- There is good publicity about the availability of number portability.
- Porting is quick.
- Porting is free (to the customer).
- Porting is simple (for the customer), involving one point of contact.
- Handsets are not subsidised.
- Service contracts are not long.
- There are several service providers with good reputations.

However, these factors do not guarantee the effectiveness of service provider number portability[100]. In addition, it can have significant disadvantages, for example:

- 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).
- It can reduce tariff transparency, as discussed in Section 14.4.2.

The main benefits of number portability can often be achieved at lower cost, through support to customers who change their numbers in letting other people know about the change. If there are announcements about changed numbers, porting the numbers may be unnecessary, except perhaps where a business depends critically on its phone numbers.

If service provider number portability is to be introduced then the moment for doing so must be chosen with care. In particular, its network implementations, like the network implementations of carrier preselection, must have suitable customer service systems run by well trained staff.

14.4.2 Tariff transparency

In Section 9.4 we emphasise the role of numbers in contributing to tariff transparency. Unfortunately service provider number portability can reduce tariff transparency, because callers may think that calls that are actually off-net calls are on-net calls. Tariff transparency in the presence of number portability can be improved by:

- Making available free information before completion of calls to ported numbers (and typically letting callers opt in or out of getting the information), through making announcements (as in Portugal) or sending tones (as in Lithuania).

[100] 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), and very little of the evidence relates to developing countries.

- 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.

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

14.4.3 Possible alternatives

For many people, free announcements about changed numbers would be as satisfactory as service provider number portability. Free announcements would also avoid problems of tariff transparency, at the cost of making callers remember or note the numbers. Many people can remember numbers of 8 digits briefly; for other people, free announcements could offer the option to callers of connecting the call to the changed number for a stated tariff.

The scheme sometimes known as ‘subscriber number portability’ has been suggested as an alternative to service provider number portability in Mongolia. It lets customers keep all the digits of their numbers except for those identifying the service provider, so (for example) **99**11 2233 might be changed to **88**11 2233, if the number is spare. This scheme was used for some time in Ireland, but it was widely regarded as not delivering the benefits that service provider number portability was expected to deliver and was replaced by service provider number portability. We do not recommend it as an official scheme. We do not recommend trying to prevent mobile service providers from offering it if they wish, where the relevant subscriber numbers are available within their own blocks.

14.4.4 Feasibility of implementation

Service provider number portability always requires the introduction of fairly complicated operating procedures: the providers losing and gaining the numbers typically need to check that the porting has been properly authorised and that the numbers being ported are valid. This is so for all networks and services. However, service provider number portability also raises complications for the implementations in the networks, as described in Section 14.1.2. These complications differ between networks and are discussed here.

In some situations, there should be few complications for the networks in porting numbers from a servco to another servco that takes service from the same netco: possibly only retail billing records will need to be changed (Of course the operating procedures will have the complications mentioned above.) These situations assume that netcos, not servcos, make interconnection agreements, so the routing of calls through networks can vary with the called number but not with the servco that assigned the called number. However, this assumption is satisfactory for VOIP services only if a change in the VOIP service provider is not accompanied by a change in the IP address associated with the called number and therefore is not accompanied by a change in the choice of routes to the called number[101].

We still make this assumption so that we can look at service provider number portability when the networks before and after the porting are different. We look at the following cases:

[101] This assumption effectively demands that IP service providers do not offer application services such as VOIP. Generally IP service providers are difficult to split into netcos and servcos: they often have minimal networks, determine the routing for application services using their IP addresses, and offer application services themselves. Demanding that they do not offer application services could weaken the business models of both them and the application service providers.

- **Porting to and from fixed networks**. For geographic numbers in some portions of the MTC network, service provider number portability might need to be implemented using call forwarding as an expedient. Of course, implementations using Intelligent Networking (IN) could be devised. However, as indicated in Section 14.1.2, we expect that these would be very expensive and would not pay off unless the demand for porting was extremely high.

  There seems to be little pressure to achieve service provider number portability between fixed service providers. As fixed access is expensive to deploy and mobile access is popular, we do not expect the pressure to rise greatly. For fixed access (in the narrow sense of analogue telephony) service provider number portability is not likely to be useful.

- **Porting to and from WLL networks**. The only established standards for the implementation of service provider number portability between WLL service providers rely on IN; there are none that exploit the particular characteristics of WLL networks. The networks are sometimes like mobile networks, except that they do not have Visitor Location Registers (VLRs). In these circumstances the implementations appropriate to mobile networks that use SRFs and HLRs may be appropriate also to WLL networks. However, these implementations envisage that recipient networks have HLRs, and, in some cases, that donor networks have HLRs; they would therefore not be suitable for porting numbers from WLL networks to fixed networks or, in some cases, for porting numbers from fixed networks to WLL networks.

  As remarked in Section 8.1, WLL services are initially substitutes for fixed services. There is certainly an argument for allowing numbers to be ported between WLL and fixed networks, just as there is an argument for allowing numbers to be geographic or non-geographic on both WLL and fixed networks. In fact, as the WLL networks are small at present, service provider number portability is unlikely to deserve investment by the WLL network providers unless it allows porting from fixed networks. Reciprocity of obligations would then indicate that service provider number portability should also allow porting to fixed networks. All of this is likely to involve substantial complications.

- **Porting to and from mobile networks**. Again, in the implementation of service provider number portability there is the possibility of using IN, but for mobile networks there is also the possibility of using SRFs and HLRs, at least when the networks both use GSM or both use CDMA. When one of the networks uses GSM and the other uses CDMA portability is harder to implement, but there are countries where service provider number portability has been implemented in this situation. However, porting numbers between GSM and CDMA usually involves changing handsets, so it may have little appeal to users. For mobile networks, as for WLL networks, there could be problems in porting numbers to and from fixed networks.

  Though the networks have some of the functions needed by service provider number portability they might not have them all. To get them all they would need to acquire, test and integrate new software loads and perhaps to acquire extra hardware capacity. For a typical release cycle from equipment vendors this process might take up to two years[102]. During that time the industry would need to design and test the operating procedures for porting numbers and negotiate the distribution of costs for service provider number portability.

- **Porting to and from VOIP services on IP networks**. VOIP services that simply use IP in the trunk network have no need for, or relation to, service provider number portability: they are simply fixed, WLL or mobile services with different trunk networks, which might be

[102] One estimate from the industry in Mongolia is one year. More refined figures would require more knowledge of the current operations and deployments of the network providers.

Next Generation Networks (NGNs). However, VOIP services that use IP in access networks do raise questions about service provider number portability. By contrast with fixed, WLL and mobile services, they are not associated with particular access network technologies and can use wireline or wireless access. They operate by mapping phone number s to IP addresses that are then used in routing calls to the numbers; this mapping might depend on a form of ENUM (discussed in Section 15.1.1) but alternatively might be implemented in several other ways. To achieve service provider number portability, network or service providers must be able to share information about this mapping. As carrier ENUM is standardised it provides an obvious way of achieving this with a centralised implementation (rather like IN).

Numbers can be ported to and from fixed, WLL or mobile networks, not just to and from VOIP services on IP networks, provided that the mapping from phone numbers to IP addresses can refer to the IP addresses of gateways between the networks, not just to the handsets. In fact, carrier ENUM is quite likely to be used in this way initially, as many trunk networks are changing to use IP before the corresponding access networks do so.

14.4.5 The split between netcos and servcos

In Mongolia, with the proposed split between netcos and servcos, there is an additional complication. Numbers are allocated by servcos to customers, who know nothing about netcos. When a number is ported it is moved from one servco to another. The two servcos may take service from different netcos. The linkage between numbers (under the control of the servcos) and routing (under the control of the netcos) is quite tight in current networks[103]. The porting processes therefore involve up to five entities (the customer, two servcos and up to two netcos), possibly with yet other entities checking that the porting has been properly authorised and that the numbers being ported are valid. The operating procedures for porting numbers will therefore be less rapid, cheap and simple than in countries without a split between netcos and servcos. Yet experience in other countries demonstrates that the effectiveness of number portability corresponds to some extent with the speed, cost and simplicity of the operating procedures[104]. The split between netcos and servcos may therefore reduce the likelihood that number portability will be effective.

Service provider number portability raises the problem of which network or service provider holds numbers after they have been ported: there could be either a secondary allocation of the numbers or a transfer of the original (primary or secondary) allocation of the numbers from one network or service provider to the other. If secondary allocations are subject to all the conditions on the use of numbers 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. It is probably the better way, at least when service provider number portability is first introduced[105]. It is in keeping with the fact that in many countries, ported numbers remain in the records of the regulator as being

[103] The linkage will become looser in NGNs, but there will remain a need to use some network-related infrastructure such as an ENUM database to link numbers to routes. As network-related infrastructure is presumably provided by the netcos, not the servcos, the complication specific to Mongolia will remain.

[104] For example, see Buehler, S., Dewenter, R., and Haucap, J., “Mobile number portability in Europe,” *Telecommunications Policy*, August 2006, Volume 30, Number 7, Pages 385-399 at http://www.ruhr-uni-bochum.de/wettbewerb/dlls/forschung/mnp-telecom-policy.pdf.

[105] 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.

allocated to the network or service providers that were allocated them initially; if this did not happen, the regulator, as well as the network and service providers, would be involved in administering the porting.

Service provider number portability brings into focus the question of what the split between netcos and servcos means for VOIP. The split would seem to require three separate providers (the network infrastructure provider, the IP network provider and the VOIP service provider), at least two of which (the IP network provider and the VOIP service provider) have relations with retail customers. As noted in Section 15.4.3, there might even be a fourth provider (the ENUM system provider) separate from the individual network and service providers. How many of these providers could be viable independently of each other remains to be seen.

14.5 Recommendations for Mongolia

If a cost-benefit evaluation were carried out for number portability in isolation, it would be unlikely to lead to a positive recommendation. For this reason we expect that number portability will not be implemented soon. At some point, however, number portability may be introduced as part of an integrated set of competition policy measures, at least for mobile service providers. On this assumption, we recommend:

1. Discouraging the use of NDCs for branding service providers pending the possible introduction of service provider number portability.
2. Encouraging the use of just the first digit 9 to mean ‘mobile phones’ (so the mobile numbers currently starting with 8 would need to be changed to start with 9).
3. Introducing, in consultation with service providers, processes for the migration of users between service providers, with the correct and speedy transfer of information for service provider number portability.
4. Attending to the other factors that contribute to the effectiveness of service provider number portability when introducing it.

15 ENUM

CRC requested information and guidance on ENUM. We do not see this topic as of immediate practical relevance to Mongolia, as ENUM is still not clearly the most appropriate or most likely way of associating phone numbers with IP addresses, even in the most advanced countries. The section therefore mainly provides background information.

15.1 General aspects

15.1.1 Forms 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 +976 1372 41234 is transformed into 4.3.2.1.4.2.7.3.1.6.7.9.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.mn and mailto:person@one-isp.net.mn, with preferences indicating that the person would prefer to be contacted using SIP but, failing that, could be contacted using email.

Figure 21 shows how ENUM domains fit with the rest of DNS.

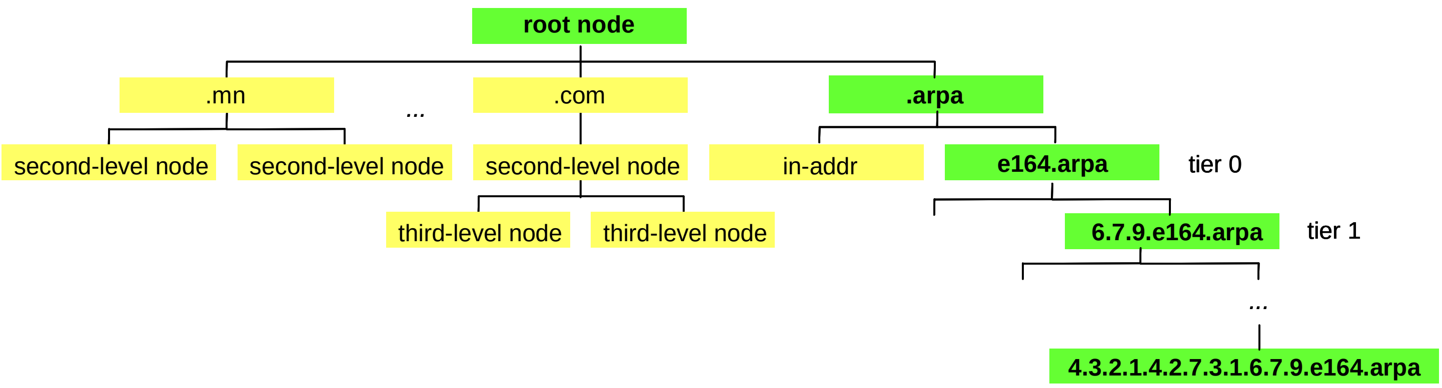

Figure 21 The position of ENUM domains in the DNS hierarchy

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. We refer to these systems as 'enum' systems[106].

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[107]. As carrier enum systems are used just by service providers instead of users, they can associate phone numbers with gateways between networks, not just with handsets. They can therefore be deployed for trunk networks that use IP even when the access networks do not use IP.
- **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.

15.1.2 Developments from ENUM

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 numbers.) 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[108]. To ensure that only valid numbers are used, there need to be agreements between the service providers and any central authority. For ENUM this central authority is provided at the global level by ITU and at the national level by a neutral organisation working with the regulator and the organisations operating 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.

[106] 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.

[107] For example, if a user has a phone number and a URI sip:person@one-isp.net.mn 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.mn from a different service provider.

[108] 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.

15.2 Experience in other countries

The ENUM standard was laid down by the Internet Engineering Task Force (IETF)[109]. It deals mainly with the transformation of phone numbers into domain names, the identification of services for communication, and the format and content of DNS records. It does not deal with various related technical matters (such as DNS security, which is the subject of several other IETF documents) or organisational and political matters. The organisational matters were taken up by the ITU; it described distinctions between the organisation responsible for managing a domain, the organisations (registries) responsible for operating the servers and the organisations (registrars) responsible for registering names on behalf of users (registrants), both globally and nationally, and discussed the security problems for users[110]. The political matters remain; they include questions over what should be the top level domain (currently arpa, which is controlled by ICANN and indirectly subject to the US Department of Commerce) and what should be the ENUM registry at a global level (currently RIPE-NCC, which has as its main function allocating IP addresses in Europe). These questions are now before the Internet Governance Forum created by the World Summit on the Information Society (WSIS). In the interim, some groups of service providers are introducing enum systems that are “unofficial” and sidestep such questions.

Despite these problems, there have been trials of ENUM systems in several countries. Often these have been led by enthusiasts for ENUM, but sponsored by their governments. (The trials in Austria are particularly well publicised, but there have been others in Ireland, Sweden, the UK and elsewhere.) Many of the trials have been concluded and the governments are now considering whether the benefits of deployment would justify active support and planning.

Following the trials, there are now plans for deploying ENUM systems in various countries. Some are carrier ENUM systems (in Poland and Romania) and some are user ENUM systems (in Austria, the Czech Republic, Germany and Ireland)[111].

However, so far ENUM systems (and indeed enum systems) have not been adopted rapidly. In particular, user enum (as opposed to carrier enum systems) 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[112].

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[109] For successive versions of this standard see *E.164 number and DNS*, RFC 2916 (IETF, September 2000) at http://www.ietf.org/rfc/rfc2916.txt, and *The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)*, RFC 3761 (IETF, April 2004) at http://www.ietf.org/rfc/rfc3761.txt.

[110] For full descriptions see *Operational and administrative issues associated with national implementations of the ENUM functions*, ITU-T Recommendation E.164 Supplement 3 (ITU, May 2004) at http://www.itu.int/rec/T-REC-E.164-200405-I!Sup3, and *Operational and administrative issues associated with the implementation of ENUM for non-geographic country codes*, ITU-T Recommendation E.164 Supplement 4 (ITU, May 2004) at http://www.itu.int/rec/T-REC-E.164-200405-I!Sup4.

[111] 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. The papers from a conference held in Australia in November 2006, at http://www.enum.com.au/news.htm, give another recent view.

[112] 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.

For reasons outlined in Section 15.4, customers may well not be enthusiastic about ENUM systems. In some countries certain non-geographic numbers have been reserved for ENUM subscribers. Though doing this may reduce number portability implementation problems for those numbers, it could well decrease enthusiasm for ENUM systems further, as customers often prefer geographic numbers.

15.3 The current position in Mongolia

Currently there is no need for ENUM. However, as VOIP spreads there will be discussions of having ENUM, particularly because of its relevance to service provider number portability (outlined in Section 14.4.4).

15.4 Considerations for Mongolia

15.4.1 Potential effectiveness

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 numbers, because it has a centralised implementation, just as has 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[113].
- 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.

15.4.2 Information security and accuracy

The trials mentioned in Section 15.2 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[114].

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[113] For example, a user having phone number +976 1372 41234 might switch from using sip:person@one-isp.co.uk to using sip:person@another-isp.co.uk without telling other users: 4.3.2.1.4.2.7.3.1.6.7.9.e164.arpa would act as a domain name for the user.

[114] 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.

- User enum lets people try to change user information about others. The changes could be intended for “slamming” (transferring a service of a user to another service provider without consent) or for redirection, perhaps to steal traffic containing business information. So 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. 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.
- User enum information is hard to keep accurate and up-to-date. Users who opt in to user enum are likely to keep their user information correct only until they stop using the numbers. Service providers may not check that the information is correct, especially when it applies to their former customers. If the system 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 whom 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. So 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 numbers tend to be personal, but VOIP is currently associated more with fixed access networks than with mobile access networks. Personal numbers, when distinguishable from mobile numbers and nomadic numbers, have not been very successful so far. So user enum is not always appropriate to holding personal preferences about communication services.

15.4.3 The split between netcos and servcos

In Mongolia, with the proposed split between netcos and servcos, there is an additional complication. Numbers are allocated by servcos to customers, who know nothing about netcos. However, ENUM systems depend on centralised databases. These databases essentially reside on the DNS servers. As the servers are infrastructure elements of networks they are presumably operated by netcos, not servcos. However, the function that they provide is essentially concerned with customer information, so they might be expected to be operated by servcos. In fact because the servers represent a meeting point between telephony and the internet, they might be well operated by providers of yet another kind.

15.5 Recommendations for Mongolia

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, in a few years' time, 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 number ranges just for enum users.
4. Introducing, in consultation with service providers, processes for the migration of users between service providers, with the correct and speedy transfer of information for enum.

16 Other classes of numbering

CRC asked for guidance on the management of Signalling Point Codes and telex numbers. For information purposes. this section provides an overview of these and other classes of numbering. We do not expect them to require special attention from CRC.

16.1 Considerations for Mongolia

16.1.1 Telephony

E.164 numbering is the main topic of this study. Various other classes of numbering are related to telephony, either because they are used in telephony networks (such as mobile networks and SS7 signalling networks) or because they are used in other public networks that traditionally have been operated by incumbent service providers. These classes of numbering are defined to some extent in international standards.

Unlike E.164 numbers, these classes of numbering are not seen by users often (or ever, in most cases), so they rarely create problems for regulators. The most likely problem is that one service provider might deliberately withhold information about allocations from another. Another possible problem is that a service provider might create shortages by having wasteful allocations. If these classes of numbering are used in services that are, or are likely to become, competitive CRC must take formal responsibility for them (though it might delegate their management to service providers).

Among these classes of numbering are the following:

- **International Mobile Station Identities (IMSIs)** as described in ITU recommendation E.212. An IMSI lets a mobile network visited by a roaming subscriber identify the home country, the home network and the individual subscriber (to get billing information from the home network, for example). An IMSI comprises a Mobile Country Code (MCC), a Mobile Network Code (MNC) and a Mobile Subscriber Identification Number (MSIN). Each MNC identifies a home network in a country. There can be 1000 MCCs, 100 or 1,000 MNCs for each MCC, and 10,000,000,000 or 1,000,000,000 MSINs for each MNC (in principle).

  ITU assigns MCCs. (The MCC is 428 for Mongolia.) CRC should be responsible for allocating MNCs to network providers (if network providers, not service providers, have HLRs, though service providers have relations with customers). Network providers should be responsible for making allocations of MSINs to service providers for assignment to end users.

- **International Signalling Point Codes (SPCs)** as described in ITU recommendation Q.708. An SPC identifies a source or destination in an SS7 signalling network. An international SPC comprises a Signalling Area / Network Code (SANC) and a Signalling Point Identification (SPI). Each SPI identifies an international gateway in a country. There can be 1,536 SANCs, and 8 SPIs for each SANC (in principle).

  ITU assigns SANCs. (The SANC is 4056 for Mongolia.) CRC should be responsible for allocating SPIs to network providers for nodes in their own networks (using criteria given in Q.708) and for notifying the ITU.

- **National Signalling Point Codes (SPCs)**. A national SPC usually has a structure similar to that of an international SPC, with a national SANC and a national SPI However, the structure might be very flat, as there might be one national SPI for each national SANC. (Different national SANCs do not need to identify different networks.)

  CRC should be responsible for allocating national SANCs to network providers. Network providers should be responsible for assigning national SPIs to nodes in their own networks (though if there is one national SPI for each SANC the network providers have nothing to do). CRC should also be responsible for maintaining any national variants of the SS7 signalling systems that use SPCs. These national variants determine (among many other things) how many national SPIs there are per national SANC. If there is one national SPI for each national SANC, then in effect CRC is responsible for allocating complete national SPCs; however, CRC might delegate the responsibility for particular ranges of SPCs to individual network providers. Unless network implementations dictate otherwise, there is no need for two network providers to have ranges of the same size, with, say, one network provider having all national SPCs of the form 1xxx and another having all national SPCs of the form 2xxx; also, there is no need to use ranges that are decimal, instead of binary or hexadecimal. However, we see no problem with the arrangements of this kind that are currently in use in Mongolia.

- **Data Network Identification Codes (DNICs) and Network Terminal Numbers (NTNs)** as described in ITU recommendation X.121. A DNIC and an NTN identify a source or destination in a public data network. A DNIC comprises a Data Country Code (DCC) and a network digit. Each network digit identifies a data network in a country. There can be 900 DCCs, 10 network digits for each DCC, and 10,000,000,000 NTNs for each network digit (in principle).

  ITU allocates DCCs. (The DCC is 428 for Mongolia.) CRC should be responsible for allocating network digits to network providers. Network providers should be responsible for making allocations of NTNs to service providers for assignment to end terminals.

- **Telex Network Identification Codes (TNICs), Telex Destination Codes (TDCs) and telex numbers** as described in ITU recommendation F.69. A TNIC, a TDC and a telex number identify a source or destination in a telex network. TNICs comprise 1 or 2 letters each and TDCs comprise 2 or 3 digits each.

  ITU allocates TNICs and TDCs. (The TNIC and TDC are MH and 800 for Mongolia.) CRC should be responsible for allocating blocks of telex numbers network providers. Network providers should be responsible for making allocations of telex numbers to service providers for assignment to end terminals.

Some classes of numbers used for routing or administration are not defined in international standards but nonetheless need to be managed by regulators. Exactly which classes of numbers are needed vary with national network structures. For instance:

- For some implementations of carrier preselection, carrier preselection codes are needed to identify service providers that carry calls because of carrier preselection.
- For some implementations of number portability, number portability codes are needed to identify nodes in recipient networks. (They are prefixed in the network to the dialled numbers, so they need to be distinguished from allocated numbers.) There may also need to be portability transit codes to let porting occur through a network that interconnects with the donor and recipient networks when they do not interconnect directly with each other.

16.1.2 Internet

Equipment associated with the internet uses several classes of addresses and names. Some of these, such as Media Access Control (MAC) addresses for Ethernet, are allocated by equipment vendors according to long-established rules. The only ones that service providers might assign are IP addresses and domain names. The current arrangements for them are as follows:

- Internationally, IP address management is handled by the Internet Assigned Numbers Authority (IANA) on behalf of the Internet Corporation for Assigned Names and Numbers (ICANN). IANA allocates IP address blocks to Regional Internet Registries (RIRs), which then re-allocate them to Local Internet Registries (LIRs) that are typically ISPs. In Asia, Asia-Pacific Network Information Centre (APNIC) is the RIR. There is perhaps a national policy matter associated with IP address management (concerning the speed of migration from IPv4 to IPv6). However, regulation by CRC does not seem necessary, as IP addresses do not raise questions of competition and customer protection like those raised by phone numbers.

- Internationally, domain name management is handled by ICANN. ICANN delegates country code Top Level Domain (ccTLD) management to organisations according to principles described in documents from ICANN and its Government Advisory Committee (GAC). The extent to which ICANN (technically subject to the US Department of Commerce) has the authority to delegate management is contentious[115]. The current manager of the mn domain name, Datacom, has not yet formalised its relations with ICANN, but we are not aware of this having caused any problems. (In fact domain managers in various developed countries, such as Canada, France and South Korea, have not yet formalised their relations with ICANN.) We understand that CRC is due to be given formal authority over domain name management, which would imply the duty to monitor the performance of Datacom and take any necessary remedial measures. As CRC are currently satisfied with the performance of Datacom, this seems like a sensible precaution for the future with no short-term implications.

16.2 Recommendations for Mongolia

We recommend:

1. Agreeing with the industry which ranges of national SPCs should be allocated by network providers under delegation from CRC.
2. Stating to the industry that potential problems with existing ways of allocating telephony codes and internet codes should be reported to CRC as soon as they arise.
3. Reviewing trends in demands for codes annually.

[115] Perhaps for this reason, there are two ways in which a ccTLD manager can formalise its relations with ICANN: there can be an exchange of letters that could be seen as passing between equals or there can be an accountability framework document that sets out the obligations of the ccTLD manager and ICANN and recognises the authority of ICANN more explicitly.

Annex A The current situation for the numbering plan of Mongolia

Introduction

This annex aims to document the situation of the numbering plan of Mongolia, as it was in March to April 2007.

The telecommunications market

Figure 22 provides statistics giving an overview of the telecom sector in Mongolia.

Company	Service type	Subscribers (thousands) 2006	National minutes (millions) 2005	International minutes (millions) 2005
Mobicom	Mobile (GSM)	615	270	7.9
Skytel	Mobile (CDMA)	123	26	-
Unitel	Mobile (GSM)	38	na	na
MTC	Fixed	143	487	6.3
Railcom	Fixed	11	10	0.4
Mobicom	WLL	13	100	-
Skytel	WLL	22	4	-
MTC	WLL	9	1	-
Sky C&C	International	na	na	1.3
Micom	VOIP	na	na	4.9
Others	International (VOIP)	na	na	4.5

Figure 22 Telecommunications market statistics[116]

Key to Figure 22: ‘na’ means ‘not available’. ‘–‘ means zero (or included in other totals).

Since 2005 there has been continuing growth in all market sectors, with mobile and WLL growing fast and a slight decline in fixed penetration. In particular, a third mobile network operator, Unitel (GSM), has started operations and a fourth, G-mobile (CDMA), has been licensed.

The use of national numbering space

Official documents (such as the numbering plan notices provided by CRC to the ITU) describe an open numbering plan that is not actually in use in Mongolia at the moment.

According to these documents, the trunk prefix 0 should be the first dialled digit of all national calls. But in fact 0 has never been used for calling from or to mobile phones, which are the great majority of all telephones in Mongolia (and in general cannot be used from mobile phones). Instead, the meaning of the first digit dialled is as shown in Figure 23.

[116] Subscriber numbers kindly supplied by CRC relate to 2006. Other figures are taken from *Results of the Study to Determine the Dominant Enterprises in the Telecommunication Service Sector*, Unfair Competition Regulation Authority, 2006

<table>
<tr><th>First digit A</th><th>Inbound international calls: + 976 A</th><th>From mobile and WLL phones</th><th>From fixed phones in Ulaanbaatar</th><th>From fixed phones in aimags and soums</th></tr>
<tr><td>0</td><td colspan="2">Not used</td><td colspan="2">Trunk prefix
(plus 8 or 9 digits)</td></tr>
<tr><td>1</td><td colspan="2">MTC fixed network
(8 or 9 digits)</td><td colspan="2">Short codes
(3 to 5 digits)</td></tr>
<tr><td>2</td><td colspan="2">Railcom fixed network
(8 or 9 digits)</td><td>Local numbers (6 digits)</td><td>Local numbers (3 to 5 digits)</td></tr>
<tr><td>3</td><td colspan="2" rowspan="2">Not used</td><td>Local numbers (6 digits)</td><td>Local numbers (4 or 5 digits)</td></tr>
<tr><td>4</td><td>Local numbers (6 digits)</td><td>Local numbers (4 or 5 digits)</td></tr>
<tr><td>5</td><td colspan="3">Government fixed network and WLL networks
(8 digits)</td><td>Local numbers (4 or 5 digits)</td></tr>
<tr><td>6</td><td colspan="2">Not used</td><td>Local numbers (6 digits)</td><td>Not used</td></tr>
<tr><td>7</td><td colspan="2">70 soft switch numbers (8 digits)</td><td>Local numbers (6 digits) and 70 (8 digits)</td><td>Local numbers (3 to 5 digits)</td></tr>
<tr><td>8</td><td colspan="4">Incomnet fixed VSAT network and Unitel mobile networks
(8 digits)</td></tr>
<tr><td>9</td><td colspan="4">Government WLL network and some mobile networks
(8 digits)</td></tr>
</table>

Figure 23 Use of the first dialled digit

We understand that the soft switch numbers starting 70 and new WLL numbers starting 5 are not designed to be accessible by fixed line customers in aimags and soums.

Figure 23 is amplified in Figure 24, which shows how the National Significant Numbers (NSNs) start.

A	Application	Number lengths	Numbers used	Preceded by 0 from mobile and WLL phones	Preceded by 0 from fixed phones (not local calls)
0	-				
1	MTC fixed network	8 or 9 digits	~150,000	no	yes
2	Railcom fixed network	8 or 9 digits	~10,000	no	yes
3					
4					
5	Government fixed network WLL	8 or 9 digits 8 digits	~3,000 ~45,000	no no	yes no
6					
7	Soft switch	8 digits	~5,000	no	no
8	Mobile	8 digits	~40,000	no	no
9	Mobile	8 digits	~750,000	no	no

Figure 24 Use of the first digit in National Significant Numbers (+976 A)

Fixed network service numbers

The conventional fixed network consists of:

- Approximately 100,000 MTC lines in Ulaanbaatar and environs.
- Approximately 50,000 MTC lines outside the Ulaanbaatar area (mainly in aimag centres but including 600 in soum centres).
- Approximately 11,200 Railcom subscribers (6,400 in Ulaanbaatar, 1,300 in Darkhan and the rest in approximately 30 separate places along the railway).

To number these, there is a detailed geographic numbering system which is summarised in Figure 25 and illustrated in Figure 26. The two fixed line operators, MTC and Railcom, share the same geographic codes, using different local number blocks in areas where they are both present.

B	Application	Codes for main towns	Codes for aimag centres	Codes for soum centres
1	Ulaanbaatar area	1 (local numbers having 6 digits)	-	-
2	Capital region	21, 22, 23 (local numbers having 5 or 6 digits for MTC or 3, 4 or 5 digits for Railcom)	272 (local numbers having 5 digits)	27yz (y=4, 5, 6; 26 codes; local numbers having 4 digits for MTC or 3 or 4 digits for Railcom)
3	Central and northern region	-	322, 332, 342, 352, 362, 372, 382 (local numbers having 5 digits)	3xyz (y=4, 5, 6; 94 codes; local numbers having 4 digits)
4	Western region	-	422, 432, 442, 452, 462, 482 (local numbers having 5 digits)	4xyz (y=4, 5, 6; 106 codes; local numbers having 4 digits)
5	Eastern region	-	512, 522, 532, 542, 562, 582, 592 (local numbers having 5 digits for MTC or 4 or 5 digits for Railcom)	5xyz (y=4, 5; 84 codes; local numbers having 4 digits)
	Total number of codes	4	21	310
	Total number of codes that include Railcom lines	3	5	13

Figure 25 Use of digits in geographic area codes (+976 1B)

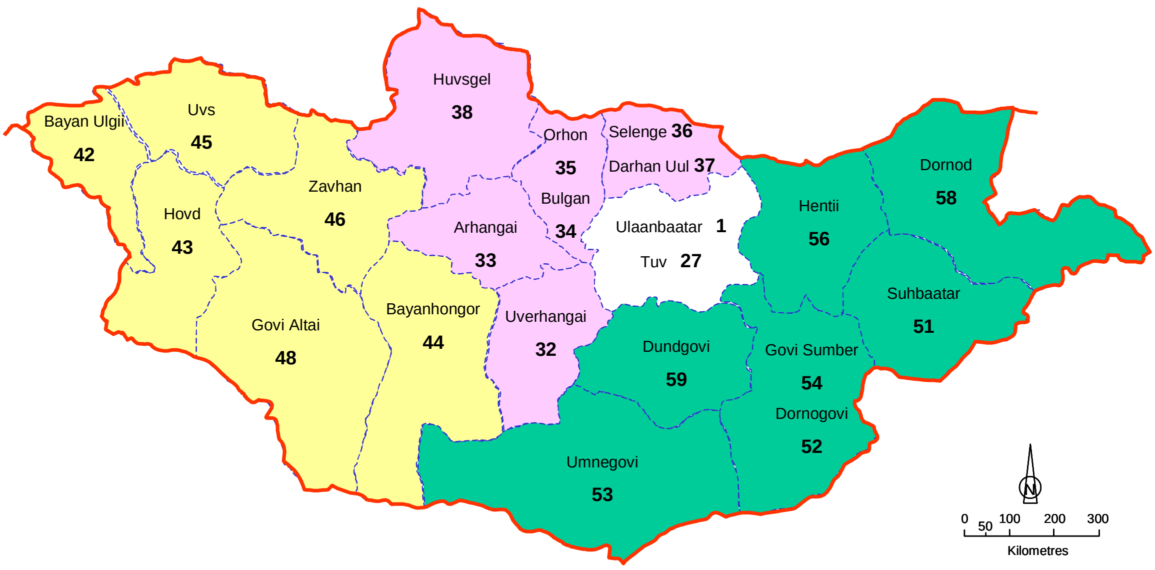

Figure 26 Locations of the geographic area codes

Figure 27 summarises the use of local number blocks (at the level of the first two digits dialled) in the fixed network in Ulaanbaatar, where Railcom use the number blocks 23 xxxx, 24 xxxx and 25 xxxx. (The local number blocks of Ulaanbaatar are those that would be dialled from abroad using +976 11 xx xxxx or +976 21 xx xxxx or +976 51 26 xxxx.) In Ulaanbaatar all local numbers have 6 digits.

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	International prefixes (3 digits)	National prefix and MTC network identification code (2 digits)	National prefix and Railcom network identification code (2 digits)			National prefix and government network identification code (2 digits)				
1	Short codes (3 to 5 digits)								Short codes (3 to 5 digits)	
2		MTC prepaid service special codes (3 digits)		Railcom local numbers (6 digits)			Government local numbers (6 digits)		Civil Aviation Authority local numbers (6 digits)	
3	MTC local numbers (6 digits)									
4						MTC local numbers (6 digits)			MTC local numbers (6 digits)	
5	MTC WLL CDMA (8 digits)		Government WLL CDMA (8 digits)	Cityfone WLL CDMA (8 digits)		Mobicom WLL CDMA (8 digits)	Skytel WLL CDMA (8 digits)		Popularcom WLL CDMA (8 digits)	
6				MTC local numbers (6 digits)					MTC local numbers (6 digits)	
7	MTC soft switch local numbers (8 digits)	MTC local numbers (6 digits)					MTC local numbers (6 digits)			
8		Incomnet fixed VSAT (8 digits)							Unitel mobile GSM (8 digits)	
9		Skytel mobile CDMA (8 digits)	Government WLL CDMA (8 digits)				Skytel mobile CDMA (8 digits)		G-Mobile mobile CDMA (8 digits)	Mobicom mobile GSM (8 digits)

Figure 27 Effect of first two digits dialled from a fixed phone in Ulaanbaatar

Key to Figure 27: the row identifies the first digit and the column identifies the second digit

In the 20 other numbering areas besides Ulaanbaatar where there are Railcom subscribers, the Railcom local numbers mainly start with 4 while the MTC local numbers mainly start with

2 or 3. In 6 numbering areas (all in the south-eastern 5 region), Railcom local numbers start with 5.

WLL network service numbers

Wireless Local Loop (WLL) networks are currently available mainly in the greater Ulaanbaatar area, where they are used to substitute for fixed lines, and also are popular as manned payphones (which helps to explain the very high minutes per phone shown for Mobicom WLL in Figure 22).

At first, WLL phones were numbered using 8-digit numbers starting with 9, similar to mobile numbers:

- Mongolia Telecom: 90CD xxxx
- Government: 9200 xxxx
- Mobicom: 95CD xxxx
- Skytel: 96CD xxxx.

Now there are plans for all WLL numbers instead to start with 5:

- Mongolia Telecom: 50CD xxxx from December 2006
- Mobicom: 55CD xxxx from March 2007
- Skytel: 56CD xxxx.

except that the Government numbers on 9200 xxxx are to stay in place for the time being.

Additional block allocations are:

- Government: 5200 xxxx
- Cityfone: 53CD xxxx
- Popularcom: 58CD xxxx.

The two new WLL licensed operators, Cityfone and Popularcom, are not currently operational.

Mobile network service numbers

Figure 28 illustrates the effect of the first and second digits dialled from a mobile phone or a WLL phone.

	0	1	2	3	4	5	6	7	8	9
0	International prefixes (3 digits)									
1		MTC FNIC and Ulaanbaatar NDC (2 digits)	MTC FNIC and capital region NDC (2 digits)	MTC FNIC and central region NDC (2 digits)	MTC FNIC and western region NDC (2 digits)	MTC FNIC and eastern region NDC (2 digits)				
2		Railcom FNIC and Ulaanbaatar NDC (2 digits)	Railcom FNIC and capital region NDC (2 digits)	Railcom FNIC and central region NDC (2 digits)		Railcom FNIC and eastern region NDC (2 digits)				
3										
4										
5	MTC WLL CDMA (8 digits)	Government FNIC and Ulaanbaatar NDC (2 digits)		Cityfone WLL CDMA (8 digits)		Mobicom WLL CDMA (8 digits)	Skytel WLL CDMA (8 digits)		Popularcom WLL CDMA (8 digits)	
6										
7										
8		Incomnet fixed VSAT (8 digits)							Unitel mobile GSM (8 digits)	
9		Skytel mobile CDMA (8 digits)	Government WLL CDMA (8 digits)				Skytel mobile CDMA (8 digits)		G-Mobile mobile CDMA (8 digits)	Mobicom mobile GSM (8 digits)

Figure 28 Effect of first two digits dialled from a mobile or a WLL phone

Key to Figure 28: the row identifies the first digit and the column identifies the second digit

The four licensed mobile operators have each been allocated one or two entire blocks of 1 million numbers, as follows:

- Unitel: 88CD xxxx
- Skytel: 91CD xxxx, 96CD xxxx
- G-mobile: 98CD xxxx
- Mobicom: 99CD xxxx, 95CD xxxx

The CD digits are used to further structure the number space, in different ways as shown in Figure 29. (At the time of writing, G-mobile had not yet started operations or announced how its numbers would be used.)

CD	Mobicom 99CD	Skytel 91CD	Unitel 88CD
00	Ulaanbaatar postpaid Mobizone		Dreamlife
0D			
11	Ulaanbaatar VIP service		Mylife
1D (D not 1), 6D	Ulaanbaatar prepaid	Ulaanbaatar	
21-59	Aimags	Aimags	
21E to 59E, E=2		D20 service[117]	
21E to 59E, E=0, 1, 3, 4		postpaid	
21E to 59E, E=5, 6, 7, 8, 9		prepaid	
60 – 69	Student service	D20 service	Student service
8D	Ulaanbaatar prepaid		Happylife
9D	Ulaanbaatar prepaid	“Business class”, Nice” brand	

Figure 29 Mobile number substructure (NDCs 99, 91 and 88)

Unusually (by international standards), mobile phones registered in aimags (rural areas) in Mongolia include identification of their home aimag in the number. This permits special local calling rates between the mobile phone and fixed phones in the same aimag to be applied.

The aimag numbering follows the geographic codes shown in Figure 25; for example, the Skytel numbers in the 33 Arkhangai area are 9133 xxxx, while the Mobicom numbers are 9933 xxxx. This means that the same capacity of 10,000 numbers is available for each operator in each aimag. Until recently this capacity was enough, but now Mobicom has run short in the Darkhan area (99 37 xxxx) and also brought into service 99 39 xxxx and 99 40 xxxx for use there[118].

Skytel has supplemented its most popular 91 mobile ranges from its 96 range, which was originally intended for WLL use. For example, the ranges 9120 xxxx, 9620 xxxx, 9169 xxxx and 9669 xxxx are all used for the Skytel ‘D20’ youth service.

The operators provide special customer services on uncharged short codes (on their own networks), as follows:

- Mobicom: 2222
- Skytel: 1515

Numbers with attractive patterns of digits (estimated to be approximately 2% of all numbers) are recognised to have special value. For example, Skytel identifies two categories:

- Numbers ending XXXX (the same digit repeated) are called ‘golden’ and are sold for an initial charge of 20,000 ₮.

[117] D20 is a youth service. In a few aimags, it has been allocated additional numbering space (eg E=5 in Erdenet).

[118] There are no aimags numbered 39 or 40.

- Numbers ending XYXY or XXYY (using just two digits) are called ‘lucky’ and are sold for an initial charge of 15,000 ₮.

In 2002 Mobitel auctioned some numbers for prepaid service. The number 9988 8888 fetched 1,740,000 ₮. Skytel achieved a price of 2 million ₮ for the number 9666 6666.

Unitel uses customer choice of number as an important part of its marketing strategy. Its first digit 8 is known to appeal especially to young people. In Mongolia, 9 is generally viewed as lucky (the more 9s, the better) and 7 as unlucky.

Specially tariffed service numbers

At present, specially tariffed non-geographic services in Mongolia are little used.

Premium rate services are delivered using certain short codes:

- 19xx, 181x, 188x and 1109 from fixed phones in Ulaanbaatar
- 15x xxxx for SMS and 14x xxxx for MMS from mobile phones

Until recently 52 xxxx codes were used for premium rate SMS from Skytel mobile phones, but these have been changed to avoid confusion with the new WLL numbers.

No freephone service is yet available, although it has been suggested that freephone could use the range (0)11 800 FG xxxx (where FG would be an operator code).

Short codes

Figure 30 indicates the short codes available on the MTC fixed network in Ulaanbaatar; customers outside Ulaanbaatar have access to only a few premium rate codes that are usually of the form 180x.

	0	1	2	3	4	5	6	7	8	9
10	Emergencies						MTC operator assistance			MTC directory enquiries
11	Premium rate 1109	Mobicom customer services						MTC long distance enquiries 117xx[119]		
12		Engineering tests								Engineering tests
13				Police in different districts						
14	MTC supplementary services[120]									
15	MTC supplementary services									
16	ISP and VOIP access 16xx									
17										
18		Premium rate 181x	MTC fault reports 18xxx[121]						Premium rate 188x	
19	Premium rate 19xx									

Figure 30 Short codes starting with 1 from fixed lines in Ulaanbaatar

Key to Figure 30: Codes are ABC, where AB is the row and C is the column

National access

Three network codes are used for accessing the fixed network in Mongolia:

- (0)1 for the MTC network.
- (0)2 for the Railcom network.
- (0)5 for the government network.

As is shown in Figure 23, the 0 must be dialled when calling from the fixed network and must not be dialled otherwise.

These three codes are not carrier selection codes. (There is not at present any choice of domestic long-distance telephone service in Mongolia, other than, possibly, dialling from a PC through VOIP.) They are not needed to help identify the called party, as all three

[119] The MTC 117xx enquiry codes are allocated to small districts in Ulaanbaatar in a logical way, with the last two digits matching the branch office number They exclude many codes that do not correspond with small districts.

[120] The 14x and 15x codes are allocated in matched pairs for activating and deactivating supplementary service. For example, 148 activates call waiting, while 158 deactivates call waiting. The same effects are obtained using *48# instead of 148 (and so on).

[121] The MTC 18xxx customer service codes are allocated to exchange areas in Ulaanbaatar in a logical way, with the last three digits matching the exchange code in the subscriber number (extended to three digits with 0 or 00 if necessary). They exclude 1818, which is a premium rate code, and many codes that do not correspond with exchange areas.

networks have their own number blocks in each geographic area where they operate. They are routing codes, which allow calls to be switched to the correct network at the second digit, without the need to analyse the early digits of the subscriber number.

There are already plans to replace (0)5 (for the government network) and (0)2 for the Railcom network by a unified fixed network code (0)1.

Most routing in Mongolia is done on the basis of analysing the first 3 digits of the number, or 4 in the case of calls to mobile. However, all relevant operators say that the depth of analysis could be increased to 5 or 6 digits without causing problems. At present, some calls for Railcom are misdialled, using the prefix (0)1 instead of (0)2; when these are detected MTC routes them to an announcement requesting that the caller redial correctly. They could, instead, be connected to Railcom.

International access

For international calls, customers of all access networks can choose their carrier through the 3-digit prefix that they use. Carriers also provide international service using VOIP with 4-digit 16xx numbers requiring secondary dialling.

Allocated prefixes are shown in Figure 31. These prefixes have the same meanings on all networks and from all locations.

There is an important interaction with competition policy: the national operators that have integrated international services (MTC and Mobicom) currently have an advantage, because they can encourage their customers to use their own international services. (For instance, Mobicom can arrange that dialling + on a Mobicom mobile phone is equivalent to dialling 003.) Skytel /Sky C&C do not have this advantage.

International prefix with carrier selection code	Carrier	16xx range
001	MTC/Magicnet	165x
002	Skytel/Sky C&C	160x
003	Mobicom	169x
004	Micom	163x
005	Railcom	166x
006	-	
007	-	
008	-	
009	-	
-	MCS	162x
-	Bodicom	164x
-	Asiatel	167x
-	Others	168x

Figure 31 Prefixes for outgoing international calls

Inbound international calls reaching all gateways are routed through an international soft switch in the premises of MTC before delivery to their final destination.

Call charge recognition

One of the most important functions of numbers is to make callers aware of what they will pay for each call. In Mongolia, there is a wide range of call charges, depending on which package the caller is using as well as which networks he is calling from and to. Figure 32 illustrates some typical call charges.

Originating network	Terminating network	Number range	Typical call charge (₮ per minute)	Comments
Fixed or mobile	Fixed	16xx		Shared revenue
Fixed or mobile	Fixed	19xx	350	Shared revenue
Fixed	Fixed	In the same aimag or both in Ulaanbaatar	12	Local
Fixed	Fixed	0 (followed by FNIC and rest of NSN)	100 to 200	Long distance
Fixed	Mobile	In the same aimag or both in Ulaanbaatar	50	
Fixed	Mobile	Not in the same aimag and not both in Ulaanbaatar	125	
Fixed	WLL	9, changing to 5	12	
Mobile	Fixed	1	200	
Mobile	Own network	8 or 9	75	
Mobile	Mobile	8 or 9	200	

Figure 32 Some typical call charges

Charges for numbers

CRC is responsible for making numbering allocations. At present, most numbering allocations are free of charge. The exceptions are:

- Annual charges of 200,000 ₮ per code apply to 16xx access codes.
- Annual charges of 50,000 ₮ per code apply to short codes used for customer service or technical purposes.
- Annual charges of 500,000 ₮ per code apply to premium rate codes.
- International access codes 00x are charged at 50 million ₮ for the first year and 0.19% of international call revenues in later years.
- Domestic access codes 0x are charged at 0.001% of domestic long distance revenue.

Various discounts apply:

- 50% off special numbers used for directory information service in aimags, and 80% off if they are used in soums.
- 10% off special number fees from the third year that a provider has been running the relevant business.

Annex B Discussion paper: the future numbering plan in Mongolia

Local numbers and local dialling (fixed network)

1. Currently the first dialled digit does not always have a clear meaning. The draft report proposes that, to provide a clear meaning, in future local numbers in the fixed network should start only with first digits 2, 3 or 4 (both in UB and elsewhere). Local numbers starting with 5 will soon be changed to start with 2, 3 or 4, so as to avoid conflict with WLL numbers starting with 5. Local numbers starting with 6 or 7 will be changed to start with 2, 3 or 4. An extra digit may be added to the numbers later, if necessary to create enough capacity.

Q1: Would making these changes give you any problems? If so, what are the problems?

2. With this proposal, in UB, MTC local numbers will start with 3 or 4, and Railcom local numbers will start with 2; while in the aimags, MTC local numbers will start with 2 or 3, and Railcom local numbers will start with 4. If another competitor wants to have geographic numbers while local dialling is still used, there will be two options:

   A. Give the new competitor vacant number blocks starting with 2x, 3x or 4x, and analyse one more digit for routing purposes.

   B. Give the new competitor local numbers starting with another digit, and at the same time move to full national dialling for all calls (see next question).

Q2a: Do you prefer one of these options to the other?

Q2b: If so, which do you prefer and why? (Or do you think that there will be no new fixed network competitors wanting geographic numbers while there is still local dialling, so that there is no need to worry? This assumes that VOIP operators in Mongolia will prefer non-geographic numbers)

3. The draft report suggests that in some years' time Mongolia may want to stop local dialling completely, as many other countries are doing. Then full national numbers will be dialled for all calls. (This does not affect charges: local calls could still be cheaper than long distance calls.) For example, in UB, instead of dialling the local number 312 345, you would dial 0 11 312 345 (the same as dialling from a mobile phone, except putting 0 before 1131 2345). The main advantage of this is that people dial in (almost) the same way from all kinds of phone. The main disadvantage is that people outside UB may have to dial much longer numbers for calls in their own areas.

Q3a: Should Mongolia aim to stop having local dialling, from both the technical and the customer points of view?

Q3b: If so, after how many years should Mongolia stop local dialling?

Fixed Network Identification Codes

4. The draft report recommends that for reasons of both fair competition and ease of use, the separate code 02 for Railcom should be merged with the code 01 for MTC (which in future would mean 'geographic numbers').

Q4a: Would merging 02 with 01 give you any problems? If so, what are the problems?

Q4b: How long would it take to solve the problems and make the necessary preparations for the merging of 02 with 01?

Structural options for the numbering plan

5. The draft report recommends that as far as possible the future plan should observe the principle of 'one main meaning for each first digit' (with possibly different meanings for the X0 series). For example, (0)1 would mean 'fixed networks (geographic numbers)' and 9 would mean 'mobile networks' (except that 90 would mean 'premium rate services').

Q5: Do you agree with this principle? If you disagree, please say why, giving examples.

6. Following the changes described in paragraphs 1 and 4 above, various long term options are possible. The table below summarises five options called A to E. They are different in the following ways:

   - Whether or not local dialling continues (discussed in paragraph 3 above – see column 2)
   - Whether or not the trunk prefix 0 continues to be used for calling fixed phones from fixed phones (see column 3). If it is not used, dialling sequences become the same from all kinds of phone; but then some conflicts arise between geographic numbers and short codes which start with 1.
   - In cases where the trunk prefix 0 is no longer used, how these conflicts are resolved (see column 4 for Options C, D and E).

   In all these options, true emergency numbers starting with 10 are unchanged.

	Key features			Example calls		
Option	**Local dialling**	**Trunk prefix 0**	**First digit 1**	**Call to fixed phone in UB from fixed phone in UB**	**Call to fixed phone in UB from mobile phone in UB**	**To police in Han-Uul District of UB from any phone in UB**
A (can still move to B, C, D or E later)	Still available on 2, 3 and 4	Still used for national calls from fixed phones to fixed phones	Still used for short codes and geographic numbers	312 345	11 312 345	134
B (can still move to C, D or E later)	None - full national dialling only	Still used for national calls from fixed phones to fixed phones	Still used for short codes and geographic numbers	0 11 312 345	11 312 345	134
C	None - full national dialling only	Not used	Still used for short codes and geographic numbers	11 312 345	11 312 345	1394 (or other code not in geographic ranges 132x to 138x), or 134 with timeout
D	None - full national dialling only	Not used	Still used for short codes but not geographic numbers	61 312 345	61 312 345	134
E	None - full national dialling only	Not used	Still used for geographic numbers and emergency call short codes but not for other short codes	11 312 345	11 312 345	234

Q6a: Should Mongolia aim to stop using the trunk prefix 0 entirely?

Q6b: If so, have you a preference between Options C, D and E, or some other idea?

Q6c: If so, after how many years should Mongolia stop using the trunk prefix 0 entirely?

Q6d: Have you any other comments on the structure of the numbering plan?

Meaning of first digits

7. The table below shows the most likely meaning for each first digit for Option C above. The meanings would be similar for the other options, with some differences shown in the comment column.

	Meaning	Comment
0	International prefix and carrier selection codes	Carrier selection codes might start with 1 or 2 (as well as, or instead of, 0). In Option B, 01 is used from fixed phones for calling other fixed phones
1	Short codes and geographic numbers	In Option D, only short codes start with 1. In Option E, only geographic numbers start with 1.
2	Reserved for unknown future use	In Option E, short codes use 2.
3	Reserved for unknown future use	
4	Reserved for unknown future use	
5	WLL numbers, and services at similar tariffs	
6	Reserved for unknown future use	In Option D, geographic numbers use 6.
7	Soft switch numbers, and services at similar tariffs	
8	Mobile, global satellite and freephone services on 80	
9	Mobile numbers, and premium rate services on 90	

Q7: Have you any comments on the meanings for first digits that are proposed in the table above?

Carrier selection codes

8. At present, the only one-stage carrier selection codes in use in Mongolia are 001, 002, 003, 004 and 005 (for international calls). Also, approximately 14 service providers are using approximately 22 codes in the range 16xx for two-stage carrier selection (at present, only for international calls). Demand is expected for more one-stage carrier selection codes, because one-stage dialling is more convenient for customers. In future, service providers may well want to offer national (domestic) calls as well as international calls using carrier selection.

   Various options for carrier selection codes are possible. The table below summarises three options called A to C. They are different in the following ways:

   - Whether or not they keep the existing carrier selection codes (see column 2)
   - In cases where the existing carrier selection codes are kept, whether they can be used as national carrier selection codes as well as international carrier selection codes (see columns 5 and 6 for Options A and B).

- Whether or not the international prefix 00 can be used on its own in the way recommended by ITU (see column 3).

In all these options, there are at least 80 carrier selection codes available: new codes might start with 0 (for example 061, 062 and so on) or 1 (for example 1601, 1602, and so on), but one range (such as 09xx or 169xx) would be reserved for expansion. Further points to note about these three options are:

- Options A and B allow the existing 001, 002 etc codes to stay in use for as long as anyone wants; in fact new ones like them (006, 007, 008 and 009) could be introduced. They do not let 00 be used by itself for international calls, so instead they would introduce a different sequence, such as 000, as the international prefix for the preselected international carrier (the alternative of 010, as in Japan, could confuse people if emergency short codes started with 10).
- Option A provides shorter international dialling sequences with the existing 001, 002 etc than with other codes, but it does not provide national dialling sequences with these codes. To be fair to all competitors, it would be necessary to charge much more for these codes than for other codes.
- Option B does not provide shorter international dialling sequences with 001. 002 etc than with other codes, but it provides national dialling sequences with these codes. It is fair to competitors without extra charging for these codes.
- Option C replaces the existing 001, 002 etc codes with other codes not starting with 00, so that 00 can be used as the international prefix. This could be done by allocating no new 00x codes, and requiring holders of the existing 00x codes to return their codes by a given time (say, by 2009).

Between these options are other possibilities. For example, by using charging we could encourage, rather than require, a result like Option B or C, or in Option A we could make available more codes starting with 00 by making them longer (for example 0061, 0062 and so on).

	Key features		Example calls		
Option	**Existing carrier selection codes**	**International prefix 00 for preselected carrier**	**International call to the USA (see note)**	**National call to a fixed phone (see note)**	**National call to a mobile phone (see note)**
A (can still move to B or C later)	Not changed and not followed by 00 for international calls	Not allowed	N: 068 00 1 201 234 5678 E: 003 1 201 234 5678 P: 000 1 201 234 5678	N: 068 (0)11 201 234 E: 003 not allowed P: (0)11 201 234	N: 068 99 11 1234 E: 003 not allowed P: 99 11 1234
B (can still move to C later)	Not changed but followed by 00 for international calls	Not allowed	N: 068 00 1 201 234 5678 E: 003 00 1 201 234 5678 P: 000 1 201 234 5678	N: 068 (0)11 201 234 E: 003 (0)11 201 234 P: (0)11 201 234	N: 068 99 11 1234 E: 003 99 11 1234 P: 99 11 1234
C	Changed and followed by 00 for international calls	Allowed	N: 068 00 1 201 234 5678 E: 043 00 1 201 234 5678 P: 00 1 201 234 5678	N: 068 (0)11 201 234 E: 043 (0)11 201 234 P: (0)11 201 234	N: 068 99 11 1234 E: 043 99 11 1234 P: 99 11 1234
Note: In the example calls, N means ‘a New carrier’, E means ‘an Existing carrier’ and P means ‘with Preselection’; also ’(0)’ means that 0 is used in calls from fixed phones to fixed phones but not in other calls.					

Q8a: What is your preference between Options A, B and C above?

Q8b: Is your answer to Q8a still the same if 00x codes not followed by 00 cost $10,000 a year? $20,000? $50,000?

Q8c: Have you any comments on other possible approaches to carrier selection?

Q8d: If Option C is chosen, how long a notice period for changing codes would you request?

Short code rationalisation

9. In future all competing service providers will be entitled to equal access to short codes, which requires some rationalisation of current codes. Recommendations in the draft report include changing short codes as follows:

    a. If some short codes are little used and no longer really necessary, withdraw them. This could soon include all the MTC 14x and 15x codes for supplementary services, as they already have equivalents using * and # (for example, *48# is the same as 148).

    b. Replace premium rate services (now 19xx) by full length national numbers starting with 90.

    c. Offer full length non-geographic national numbers (with a suitable charge) to internet service providers, to use instead of 16xx codes.

    d. Get MTC to work towards combining its many service enquiry codes into just a few, maybe using automatic routing based on CLI (calling line identification), or through an IVR (interactive voice response) system.

    The draft report also recommends that a CRC/industry working group should identify short codes to be used in the same way by all service providers (for example, for fault reporting or directory enquiries), and short code ranges to be used by each service provider in any way it chooses.

Q9a: Do you agree with the recommendations (a) to (d) above? Please identify any problems or reasons for disagreement.

Q9b: Would you work in a CRC/industry working group as recommended above?

Mobile numbering

10. The main problem identified with mobile numbering is that identifying aimags in the numbers (to make special charging possible) leads to a shortage of numbers in some aimags. There have also been proposals for new numbering for value-added SMS/MMS (to be shared by all mobile operators), and for introducing mobile number portability.

Q10a: When will it be possible to do without aimag identification in mobile numbers?

Q10b: The draft report suggests that it would fit better with the rest of the numbering plan for the new value-added SMS/MMS numbering to start not with 14 or 15, but instead with 90 or another non-geographic code. Is this suggestion acceptable to you? If you have any preferences for alternative codes, please explain them.

Q10c: The report will say that for mobile number portability to work well from the user point of view, it would be best if all mobile numbers started with 9 (so that 9 would mean ‘mobile numbers’). What is your view on this?

Numbering administration

11. CRC has requested guidance on international good practice in numbering administration. This mainly relates to allocating and using number blocks in an efficient way. CRC have also requested advice on using number charges to create incentives for service providers to use numbers carefully.

Q11a: What do you consider a reasonable level of number block utilisation that CRC should require before issuing a new block for the same service? (Elsewhere, 50% - 60% is a normal utilisation requirement). Does this differ for different services?

Q11b: Would an annual charge of US$10,000 per 1 million block (or $1,000 per 100,000 block, and so on – that is, 1 cent per number) encourage your company to request numbers in smaller blocks? In what other way would such charges affect your company?

Other comments

12. Please identify any other problems related to numbering in Mongolia that you are aware of.

13. Any other comments you would like to offer on any of these issues, or anything else raised in the draft report or presentation you have seen, will be very welcome.

Annex C Abbreviations

APNIC	Asia-Pacific Network Information Centre
CC	Country Code
ccTLD	country code Top Level Domain
CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications Administrations
CLI	Calling Line Identification
CRC	Communications Regulatory Commission
CSC	Carrier Selection Code
DCC	Data Country Code
DNIC	Data Network Identification Code
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
FNIC	Fixed Network Identification Code
GAC	Government Advisory Committee
GMSC	Gateway Mobile Switching Centre
GSM	Global System for Mobile communications
HLR	Home Location Register
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
IETF	Internet Engineering Task Force
IMSI	International Mobile Station Identity
IN	Intelligent Networking
IP	Internetwork Protocol
IPTV	IP TeleVision
IPv4	IP version 4
IPv6	IP version 6
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
MCC	Mobile Country Code
MMS	Multimedia Messaging Service
MNC	Mobile Network Code

MSIN	Mobile Subscriber Identification Number
MTC	Mongolia Telecommunication Company
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
NIC	Network Identification Code
NSN	National Significant Number
NTN	Network Terminal 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)
RFC	Request For Comment
RIPE-NCC	Réseaux IP Européens – Network Coordination Centre
RIR	Regional Internet Registry
SANC	Signalling Area / Network Code
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SMS	Short Messaging Service
SN	Subscriber Number
SPC	Signalling Point Code
SPI	Signalling Point Identification
SRF	Signalling Relay Function
SS7	Signalling System 7
STP	Signalling Transfer Point
TDC	Telex Destination Code
TNIC	Telex Network Identification Code
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
VLR	Visitor Location Register
VOIP	Voice Over IP
VPN	Virtual Private Network
WLL	Wireless Local Loop
WSIS	World Summit on the Information Society