World numbering trends and implications
Colombia National Numbering Conference
July 2001

Claire Milne
http://www.antelope.org.uk
mailto:cbm@antelope.org.uk
tel: +44 20 8505 9826

Antelope Consulting
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
Numbering terminology

- Numbering scheme/numbering plan
- Numbering plan/dialling plan
- Trunk prefix/international prefix
- Open numbering plan/closed numbering plan
  - National significant number (NSN) (length)
  - Country codes (CC)
  - National destination codes (NDC) (trunk code, area code or service code)
  - Subscriber number (SN)
Motivations for numbering changes

• Enhancing the primary customer/network interface (possibly a big revenue generator)
• Capacity for growth and new services: current plans were devised before this could be foreseen
• Essential resource for competitors: regulators must ensure fairness for all (number portability becoming standard)
Requirements for numbering plans

- Provide adequate numbering capacity for all services and new developments for 20 to 30 years ahead
- Be user-friendly (simple, clear information, uniform lengths, stable)
- Provide equal access to resources for all competitors (perhaps with portability)
- Be easy for the regulator to administer
Measures of capacity –
ETO/Ovum study guidelines

- Usable geographic space per person (1 to 3?)
- Number of free 3-digit SN blocks (5 to 20%?)
- Space available per person for non-geographic services (2 to 5?)
- Number of 3 digit short codes avail. (100+?)
- Number of free 2 digit NDCs (5 to 20?)
- Ease of creating additional capacity
- Ease of closing the plan
Numbering for customers

- For making calls correctly
  - should be easy to remember or find, and reproduce
  - should have uniform number patterns
  - should change infrequently
- For receiving calls correctly
  - should not be readily misdialled from any other much-called number
  - should change infrequently
- For deciding whether to make a call
  - should give wanted information (eg cost)
Consistent user preferences

- Minimise frequency of number changes
- Keep own number when moving locally or changing operator
- Have a single number length and uniform patterns (even at the cost of dialling extra digits)
- Understand from early digits of number:
  - rough tariff; service type; location called
  - not the network operator
Number presentation

• Layout of numbers greatly affects memorability
• Human factors research shows chunking helps, groups of 3 or 4 digits best (eg as in NANP, XXX XXX XXXX)
• However, the meaning of early digits also affects memorability (eg 800, 70)
• In an open scheme users must know where local numbers start (eg (020) 8505 9826)
• Each scheme needs its own solutions
Differences of opinion

• Keeping local dialling (matters more to residential users and with long trunk codes)
• Significance of special numbers (cultural factors)
• Desirability of international harmonisation (eg of short codes)
Reconciling user-friendliness and harmonisation (ETO/Ovum)

• Require clear cost-benefit or social justification for all harmonisation:
  – main beneficiaries of international harmonisation are frequent travellers, a minority
  – costs of co-ordinated numbering of new services much less than costs of renumbering existing services

• Plan transitions carefully: if new codes replace old ones, old ones should be phased out soon

• Give wide publicity to the justification and benefits of any new codes.

Antelope Consulting
Competitive requirements of numbering schemes

• Local number capacity
• Carrier selection codes
• Number portability
• Capacity for new services
• Short codes
Local number capacity

• Normal for all competitors to share any geographic significance of numbers
• Only problematic if all ranges already in use, or if many competitors want new ranges in an area (cf Reading)
Carrier selection codes

• Much less important if equal access preselection introduced for long-distance carriers (can then use longer codes)
• 10XXX range commonly used, or other 1YXX short codes
• 0X or X option less widespread and potentially confusing
Number portability

- Local (operator) number portability a serious option wherever there is competition and modern exchanges
- Also consider freephone and mobile (operator) number portability
- Customers may want geographic portability (locally or nationally) or service portability
Capacity for new services

• All competitors must share nationally recognised codes (eg freephone, premium rate)
• Some competitors may want “special” service space (limited branding permitted?)
Short codes

• International harmonisation for a few codes (eg 112)
• National harmonisation for several more (eg DQ, fault reports, CLI suppression)
• Some space for individual operators to use as they want
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
World numbering trends

• Country codes
• National numbering plans: common principles
  – overall architecture and dialling plans
  – geographic numbering
  – short codes and new services numbering
• Open and closed numbering schemes
• International harmonisation
Country code developments

• Potential shortage of codes:
  – no new 2-digit codes
  – end of regional structure

• Move to 3-digit codes for all on hold?

• New non-country codes:
  – +800, +808 freephone, shared cost
  – +979 X premium rate
  – +878 UPT
  – +881X, +882XX GMSS, global networks
  – +388X country groups (+3883 Europe)
Common principles for overall architecture and dialling plans

- Minimise number changes
- Retain an easy migration path to an extra digit
- Retain option of moving to a closed numbering plan
- Have standard dialling procedures
- Have common carrier selection procedures
Common principles for geographic numbering

- Have uniform PSTN number lengths
- Avoid using 0 or 1 to start SNs
- Simplify geographic PSTN number structures
- Share geographic structure among all competitors
- Retain option of operator portable numbers
- Restrict the amount of numbering space occupied by the PSTN
Common principles for short codes and new services numbering

• Reserve 1XX, or at least 1NX (N = 0, 1), for short codes
• Use short code space sparingly
• Adopt distinctive NDCs for new services
• Ensure user recognition of the main tariff distinctions
• Share "special" NDCs among all competitors
• Harmonise short codes and NDCs internationally where justified
Open and closed numbering schemes – what?

• Fundamental architectural feature of a numbering scheme:
  – closed scheme: single dialling procedure (no trunk prefix), usually single uniform number length
  – open scheme: separate local and trunk dialling procedures, perhaps varying lengths of codes and subscriber numbers

• Closed schemes commoner in countries with:
  – small area (eg Hong Kong)
  – small population/number of lines (eg Norway, Denmark)
  – NSN 8 or less
Open and closed numbering schemes – which?

• Advantages of open scheme
  – provides shorter numbers for local calls
  – keeps geographic area identities

• Advantages of closed scheme
  – has no need for trunk prefix (one digit less on national calls)
  – has a uniform dialling procedure for all calls
  – allows higher capacity utilisation
  – makes portability easy to introduce
  – is the simple way to expand a number plan
Balance of advantage moves towards closed schemes

• More people have modern phones (number of digits matters less)
• Geographic structure gets simpler, area codes shorter
• Non-geographic services are called more and international traffic grows
Some new services and their numbering

• Mobile - any unused blocks, often 09 or 01
• Freephone - 0800 de facto standard
• Premium rate - 0900 somewhat standard
• Other special tariffs - often 08XX
• Personal numbers, voicemail etc - often 07
• GMPCS - perhaps numbered globally (country code) or nationally (as mobile?)
## Typical new use of NDC space

<p>| | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>International access</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Reserved for short codes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NG Geographic numbering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NG Geographic numbering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>NG Geographic numbering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NG Geographic numbering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NG Reserved for long-term flexibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Non-geographic numbering (personal and mobile)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Non-geographic numbering (freephone etc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Non-geographic numbering (premium rate etc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Antelope Consulting**
# ITU-conformant plans and the NANP

<table>
<thead>
<tr>
<th>Feature</th>
<th>ITU-conformant</th>
<th>NANP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk prefix</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>International prefix</td>
<td>00</td>
<td>011</td>
</tr>
<tr>
<td>Short codes</td>
<td>1XX (100)</td>
<td>N11 (9)</td>
</tr>
<tr>
<td>Emergency code</td>
<td>112 (EU, GSM)</td>
<td>911</td>
</tr>
<tr>
<td>Operator</td>
<td>1YZ</td>
<td>0</td>
</tr>
<tr>
<td>Carrier selection codes</td>
<td>1AB(C)</td>
<td>10X XXXX</td>
</tr>
<tr>
<td>Use of 0</td>
<td>Trunk prefix</td>
<td>Operator</td>
</tr>
<tr>
<td>Use of 10</td>
<td>Short codes</td>
<td>Carrier selection</td>
</tr>
<tr>
<td>Use of 11</td>
<td>Harmonised short codes (EU)</td>
<td>Substitute for *</td>
</tr>
<tr>
<td>Use of 1X</td>
<td>Short codes</td>
<td>Long distance dialling</td>
</tr>
<tr>
<td>Uniformity</td>
<td>Variable but increasing</td>
<td>Complete (1 XXX XXX XXXXX)</td>
</tr>
<tr>
<td>Geographic relief methods</td>
<td>Extra digit, code changes</td>
<td>Area splits, overlays</td>
</tr>
<tr>
<td>Mobile services numbering</td>
<td>Special ranges</td>
<td>Mainly in geographic codes</td>
</tr>
<tr>
<td>Special services numbering</td>
<td>Special ranges</td>
<td>X00, 8XX codes (toll-free)</td>
</tr>
<tr>
<td>Closure</td>
<td>Increasing</td>
<td>Overlay means local dialling lost</td>
</tr>
</tbody>
</table>
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
Some recent numbering scheme reviews

- UK
- Australia
- NANP
- France
- Germany
- Netherlands
- Hong Kong
- Spain, Italy, Portugal, Switzerland
United Kingdom

• Early STD system: trunk codes based on place names, using 75% of NDC space
• Need for change clear to BT in early 1980s, started in the early 1990s and still going on
• London split (from 01 to 071 & 081); free 1 then prefixed to all geographic numbers
• Geographic relief now from 02
• New services on 07, 08, 09
Australia

- Primary driver for change was shortage of geographic capacity
- Thorough evaluation of options included large-scale customer research
- Changes retained open plan but with only 4 instead of 54 geographic areas
- Changes were phased over 6 years
NANP

• Still at 10 digits though 11 or 12 may be needed (cost estimate ~$100bn)
• More area codes released by allowing middle digit to take any value (formerly just 0 and 1)
• For Freephone 888, 877 provided, as well as 800
• Geographic expansion through overlay or split
• Conservation through rate centre consolidation and number pooling (allocation in blocks of 1,000 instead of 10,000)
France

- Standard trunk code 0 adopted (formerly 16)
- Five large geographic areas coded 1 to 5
- New services on 6 to 9
- All digits to be dialled for all calls
- Non-zero first digits for carrier selection
Germany

- No immediate change needed despite the introduction of competition
- Full review planned in the medium term
- Preselection required
- Local number portability required where possible
- Special codes reserved for new services
Netherlands

• Uniform open 9-digit scheme, with 2- and 3-digit area codes (formerly many 4-digit codes)
• Subscriber numbers starting 1 all changed
Hong Kong

- Closed uniform 8-digit scheme without geographic significance
- Sharing of same number range by all competitors
- Local number portability required
Spain, Italy, Portugal, Switzerland

- All recently closed their numbering plans
- Spain: trunk code 9 assimilated to front of numbers, 9 digits in all numbers, now always dialling 9
- Italy: rather complex staged transition, non-uniform number length
- Portugal: 2 prefixed to all geographic numbers, now always dialling 02
- Switzerland: closing by dialling full national number, later changing Zurich from 1 to 44
Numbering in developing countries

• The numbering scheme may sometimes be changed before doing so is necessary:
  – small but fast growing user base: user costs of change will rise with time
  – often, mainly modern exchanges: system costs of change will not fall much

• However, additional factors need consideration:
  – poor number information: changes must be easily described
  – many occasional users: very simple approach is needed (eg uniform closed scheme)
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
Numbering plan review principles

- Have sufficient capacity for plan period and indefinitely
- Improve user-friendliness
- Ensure robustness for competitive environment
- Make implementation as easy and cheap as possible, subject to the above
Numbering forecasting

• Forecasting connections to a service is already difficult
• Forecasting numbers is much worse because one connection may have several numbers (and nobody knows how many): DDI, ISDN, differential ringing tones…
• The achievable utilisation depends on block and routing structure: 50% is generally good
• It is safest to plan for the highest believable outcome
Consultation and advisory bodies

- Numbering can fast become a political “hot potato”: everyone has an opinion (bicycle shed syndrome)
- Consultation is essential, but many people have little grasp of the issues
  - produce very simple consultation papers for the general public
  - consider an “expert” advisory group to ensure that major likely objections are taken into account early
Implementing numbering change – network operators

- Changes to exchanges of different types (gradual to avoid unacceptable risk)
- Recorded announcements for misdialled calls
- Changes to operational support systems (e.g., directories, any computer system holding telephone numbers)
- Changes at international exchanges by overseas correspondent administrations
Implementing numbering change –
the general public

• Assent to the change (justification needed?)
• Advance publicity (far enough but not too far ahead, for, say, diary publishers)
• Period of parallel running (this may heavily influence the chosen change)
• Support for changes to customer premises equipment, especially payphones and automatic alarms
Implementing numbering change – steady stages versus “big bang”

• “Big bang” may be simpler to publicise and straightforward for the public
• Staged change has a flatter resource profile and implies less commitment to precise dates
• With complex changes, staged changes may be easier for the public to assimilate
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
Number ownership

• From one point of view, numbers belong to the nation: a shared “natural resource”
• From another point of view, my phone number belongs to me and I should be allowed to keep it as long as I “behave well” with it
• In practice, usually the incumbent telephone company controls the numbers
• The position of systemless (‘virtual’) service providers is unclear
Callers and called parties

• Callers are entitled to:
  – find out numbers
  – recognise useful information in numbers (eg what service they are calling and what the call will cost)

• Called parties are entitled to:
  – keep their numbers (enhanced by portability)
  – publicise or refrain from publicising their numbers

• There can be conflicts, as seen already with:
  – lots of ex-directory numbers
  – ported mobile numbers (for which callers do not know costs)
  – costly personal numbers advertised in misleading way
Rights of called parties (1)

- uninterrupte use of an unchanged number, subject to:
  - overall national management of the plan
  - the user paying service dues and abiding by terms of contract
  - practical considerations (eg exchange areas, portability implementation)
Rights of called parties (2)

• Privacy and freedom from unwanted calls
  – Direct marketing calls
  – Misdialed calls to heavily called numbers

• Choice of preferred number, including buying and selling numbers
  – Dependent on individual number allocation (INA)
  – Controversial but increasing, especially for freephone
Outline

• Numbering requirements
• Numbering trends across the world
• Some examples of national numbering changes
• Principles for numbering plan reviews
• Rights and obligations of use for numbering
• Numbering administration
Number administration – who?

• In competitive environment, number administration must be independent of all market players, so the regulator is usually responsible
• But it may be sensible for the regulator to get some of the work done elsewhere (cf NANPA), after defining the split between policy and practice
• Lower level allocations entail more work
• INA entails the most work
Number administration – how?

• Traditionally, large block allocations are made manually to operators.
• Some number ranges are moving towards INA to end users, so computer support necessary.
• Either way, need to work out charging arrangements (pricing to reflect cost or value? auctions?)
Numbering plans and portability

- A numbering plan can inhibit or facilitate portability, but never require it
- Local dialling limits geographic portability to the local dialling area (NDC)
- Steep tariff gradients need clear signs to callers (so open plans help but impede portability hard)
- Flat tariffs accompany closed plans and full national portability
- Network intelligence determines the cost and practicality of portability and of INA, as well as the efficiency of number utilisation