World numbering trends and implications
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1

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

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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)

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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)

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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

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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

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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)

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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

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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

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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)

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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.

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Competitive requirements of numbering schemes

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

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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)

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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

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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

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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?)

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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

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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

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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)

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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

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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

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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

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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

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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

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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

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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?)

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28

Typical new use of NDC space

	0	1	2	3	4	5	6	7	8	9
0	International access									
1	Reserved for short codes									
2	NG	Geographic numbering								
3	NG	Geographic numbering								
4	NG	Geographic numbering								
5	NG	Geographic numbering								
6	NG	Reserved for long-term flexibility								
7	Non-geographic numbering (personal and mobile)									
8	Non-geographic numbering (freephone etc)									
9	Non-geographic numbering (premium rate etc)									

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ITU-conformant plans and the NANP

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

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Some recent numbering scheme reviews

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

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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

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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

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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)

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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

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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

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Netherlands

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

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Hong Kong

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

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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

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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)

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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

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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

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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

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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 (eg directories, any computer system holding telephone numbers)

- Changes at international exchanges by overseas correspondent adminstrations

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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

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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

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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

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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

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Rights of called parties (1)

- Uninterrupted 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)

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Rights of called parties (2)

- Privacy and freedom from unwanted calls
  - Direct marketing calls
  - Misdialled 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

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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

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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?)

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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

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