

Cellular Networking Perspectives

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In This Issue ...

The North American Numbering Plan is bursting at the seams and Cellular Carriers are complaining that its resources are not being allocated fairly. This plan, which for years has defined how calls are dialed within North America, was not designed to handle the huge number of phones now in use in major cities, particularly Los Angeles and New York City. Nor was it designed to handle new services such as Cellular. This issue of *Cellular Network Perspectives* examines the capacity problem and the solutions proposed by the Numbering Plan Administrator, in particular for their impact on the cellular industry. In the October issue, some alternative solutions and the topic of control over the North American Numbering Plan will be addressed.

This issue also starts a series of short articles that examine the mandate and activities of the TIA TR45.2 sub-committee in more detail. This group has responsibility for all cellular interface standards outside the air interfaces, such as intersystem handoff and call delivery protocols.

We Are Moving

The office of *Cellular Network Perspectives* is moving. Unfortunately telephone number portability is still in the future so our phone and fax numbers have to change! The new information is:

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Problems in the North American Numbering Plan (NANP)

The North American Number Plan was designed in the 1940s to provide direct dialed long distance within North America. The NANP was not designed with a crystal ball, so the high rate of penetration of phones, the invention of new services such as cellular and the massive population increase in cities such as Los Angeles was not foreseen. The NANP is now close to running out of numbers, and in some areas undesirable numbering changes have had to be made in order to avert exhaustion. Because of the scarceness of numbering resources, wireline carriers, which control allocation, are reluctant to assign numbers to cellular and paging carriers in conveniently sized blocks.

The telecommunications industry has recognized the capacity problem for some time and earlier this year Bellcore, which has responsibility for managing the NANP, produced a report that identifies a potential solution. That report generated many responses, in some cases strongly opposed to its recommendations. The problems in the NANP and the controversial issues in the Bellcore report will be summarized in this and a subsequent article. The report, with comments, is available by contacting James Deak at Bellcore (201-740-4594).

NANP Design Restricts Growth

The NANP was designed with two major constraints in mind: the long time required to dial each digit on a rotary dial phone and the limited capabilities of telephone switches of the time. To avoid burdening local callers with long dialing times 7 digit dialing was allowed, 10 digit dialing being required only for calls to a different Number Plan Area (NPA). To make this

feasible with the switch technology of the time, it was necessary to restrict the values of some digits so switches could distinguish between 7 and 10 digit dialing before all digits were received. The format of an NANP address originally was:

NYX-NNX-XXXX

(*N* represents a digit restricted to the values 2 through 9, *Y* a digit restricted to 0 or 1 and *X* an unrestricted digit). Due to these restrictions only 144 area codes were possible (160 less 16 N11 and N00 codes used for other purposes), each with 640 central office (CO) codes.

When some large cities started to run out of CO codes in the 1970s the restriction on the second digit of the CO code was lifted. This change affected only 7 digit dialing so required only the upgrading of switching equipment inside one NPA. The new NANP address format was:

NYX-NXX-XXXX

which allowed the same number of area codes, but 800 CO codes in each NPA.

NPA Splits and Overlays

Even with these new CO codes, some areas eventually ran out again. Each time this occurred the existing NPA was split into two. Subscribers in one portion of the area would retain the existing area code while those in the other would be assigned the new area code. Splitting an NPA, however, has a significant impact on subscribers, callers to those subscribers and telephone operations. Subscriber phone numbers have to change. Callers to the area have to be informed and have to update their telephone directories. Telephone switches all over North America have to be reprogrammed with the new area code. Also, subscribers have to be educated about when the change will occur, under which

circumstances 10 digit dialing will then be necessary and they have to be convinced that it will have no effect on calling rates.

As an alternative to an NPA split, an overlaid NPA has been implemented in New York City. The new area code, 917, was populated with cellular phones and pagers, with other phones remaining in existing area codes 212 and 718. An overlay is particularly onerous for cellular operators, that have the extra expense and inconvenience of recalling and reprogramming cellular phones for all their subscribers.

As exhaustion of all available NPAs came close, Bellcore decided to plan for the future of the NANP, hoping to modify it in the mid 1990's to be able to handle expansion well into the next century.

The Bellcore Proposal

The Bellcore proposal suggests that the solution to NANP capacity problems lies in *Universal 10 digit dialing*. While eliminating 7 digit dialing for local calls does not by itself solve any problems, it does allow for the removal of restrictions on digits, with a resulting large increase in area codes and a modest increase in central office codes:

- Remove the restrictions on the second NPA digit will increase the number of area codes by more than 5 times, to 800.
- Removing the restrictions on the first CO digit will increase the number of central office codes in each NPA by 20%, to 1,000.

Some problems with this Bellcore proposal are:

- 3 more digits must be dialed for all local calls.
- CO codes are required more than area codes.
- No alternative solutions were discussed.
- Numbering resources will continue to be allocated by local exchange carriers and Bellcore.

Bellcore Vision: Forward or Back?

The Bellcore proposal is their vision of the future of the NANP. In the next issue of *Cellular Network Perspectives* we will discuss whether their vision is toward the past or toward the future. Several topics will be addressed:

- Alternatives to the Bellcore proposal.

- Control of the NANP.
- Conservation of numbering resources?
- The numbering needs of wireless telecommunications services such as cellular.

TR45.2 - The Cellular Standards Committee

The TIA sub-committee TR45.2 can better be defined by the responsibilities it does not have, than by those that it has. It is not responsible for cellular air interfaces, but for all other cellular-specific interfaces requiring standardization. These interfaces include MSC-MSC, MSC-VLR-HLR and User-MSC. The sub-committee is chaired by John Marinho of AT&T.

The premier responsibility of TR45.2 is standardization of the MSC-MSC and MSC-HLR interfaces in TIA Standard IS-41. This standard initially covered inter-system handoff and roamer validation (Revision 0), but has more recently been extended to Call Delivery and use of features while roaming (Revision A). The sub-committee has also standardized the use of features such as call forwarding (Terminal User to HLR interface) in IS-53. New standardization efforts involve the transfer of call records over an MSC to Billing Center interface and possibly even the MSC-PSTN signaling interface.

The work of TR45.2 is certainly not restricted to writing new standards, most work is instead devoted to keeping existing standards up to date. Extensive work has gone into upgrading IS-41 to support digital cellular inter-system handoff and to support mobile authentication. Problems with handoff and call delivery in areas bordering two or more cellular systems are being addressed, and features not yet standardized in IS-53, such as calling party identification, are being defined appropriately for a cellular environment.

Future articles will discuss the individual working groups and standards of TR-45.2

Glossary

Address•The full identity of a telephone terminal. In the NANP, addresses are currently 10 digits, in the format (NYX)-NXX-XXXX.

Area Code•A 3 digit code assigned to an NPA. Currently restricted to the digits NYX, resulting in 160 possible area codes,

of which 16 are lost to service codes (e.g. 911 and 800).

Bellcore•The research organization owned by the Local Exchange Carriers (LECs) that arose from the divestiture of AT&T. This organization inherited responsibility for the NANP from AT&T.

HLR•Home Location Register; the repository for cellular subscriber validation and profile information.

IS•Interim Standard; a standard that has not yet received ANSI approval.

MSC•Mobile Switching Center; a cellular telephone switching office.

N•A digit in an address that must be in the range 2 through 9.

NANP•North American Numbering Plan; the dialing system in use in WZ1.

NPA•Numbering Plan Area; a major subdivision of the NANP. See **Area Code**.

Overlay•An NPA with more than one area code. New York 917 is the only example so far.

Split NPA•An NPA that has been split into two geographically distinct areas, each with its own area code.

TIA•Telecommunications Industry Association.

WZ1•World Zone 1; USA, Canada and the Caribbean.

X•An address digit that may be any value from 0 through 9.

Y•An address digit that must be 0 or 1.

Comments Welcome

Comments on any article in this newsletter are welcome, whether they be criticisms, additional information, suggestions for future articles or even praise.

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