Cellular
Networking
Perspectives

Feedback on Number Pooling

Our article on Number Pooling (March, 2001) generated a considerable amount of interest. Perhaps it is not a good sign when even the 'experts' are confused!

Jim O'Neill (joneil@ix.netcom.com), a well-known billing consultant, writes:

> I confess to being a bit confused regarding the comment that number pooling only works if Wireless carriers retain the same rate center boundaries as the LECs and that efficiency is reduced if they do not.

> I am aware of a number of smaller markets having only been granted less than full number blocks for quite a while. From the cellular billing perspective we used an arbitrary NPA-NNX to define the originating point for toll. What am I missing regarding efficiency?

Our response:

> If a wireless carrier assigns numbers to an area larger than a rate center (as they usually do), billing will be to an arbitrary rate center somewhere within that area. This works for wireless carriers, that have sometimes even subsidized the costs their customer's callers incur in intra-LATA toll, because of the benefits of a wider local calling area.

> This arrangement may not be acceptable to other carriers (e.g. CLEC's) that may be assigned

numbers taken away from a wireless carrier, although we admit it would be possible to take numbers from a wireless carrier used to cover multiple rate centers, and then assign them to other carriers for use only within the one rate center to which the numbers 'officially' belong.

It is true, many wireless carriers are currently assigned less than full (i.e. 10,000) number blocks. In these cases, they are treated as if they were a PBX, not a Class 5 (local exchange) switch, and these are probably forced to use Type 1 (line) connections to a LEC instead of Type 2A (trunk) connections directly to an access tandem or long distance carriers.

As an alternative to pooling, 7 digit analysis could be implemented by toll switches (currently, analysis is 6 digits) to allow carriers with partial blocks of numbers to have fully capable interconnection with the PSTN. This is an alternative to number pooling; it does not require LNP infrastructure, and, as far as we can tell, it has never been considered by the FCC. The impact of this would be significant, but its significance would probably not be as great as implementing LNP.

Michele Young (michele@enzweiler.com), an expert in numbering issues, noted that the States, and not just the FCC, are behind number pooling. She also noted that 'D' digit expansion was recommended by the telecom industry, but it was rejected by the FCC (for now).

MIN Block Assignment

The CTIA has issued a Request for Proposal to act as the MIN Block Identifier (MBI) administrator. This is an important step in separating the MIN from the MDN in North America. Although it is driven by the impending local number portability deadline, benefits will be more wide-ranging than this.

What is a MIN?

A MIN (Mobile Identification Number) is always a 10 digit number, and it is the subscription identifier used by most systems, such as: AMPS/N-AMPS analog, D-AMPS TDMA digital and TIA/EIA-95/IS-2000 CDMA digital cellular or PCS systems.

In North America, the MIN is usually, but not always, artificially constrained to be the same as the 10 digit form of the Mobile Directory Number (MDN). Note, whereas a MDN may have many forms (e.g. 1-403-870-3736, 403-870-3736 and 870-3736 may all reach the same phone) a MIN is always a 10 digit, fixed length number.

Outside the North American Numbering Plan (NANP), to avoid ambiguity, most analog, TDMA and CDMA phones are programmed with an IRM (International Roaming MIN). This is a MIN beginning with 0 or 1, which thus cannot conflict with a North American MDN-based MIN. IRM blocks are assigned by:

www.ifast.org.

GSM does not use the MIN as an identifier; it uses the IMSI instead. This identifier has a completely different format than the MDN (or MSISDN, as it is known in GSM standards).

MIN versus MDN

The MIN is used to identify a mobile subscription over a compatible radio interface and within the TIA/EIA-41 network. The MDN is used to make a phone call to a mobile. There is no difference between a directory number and an MDN, except for the type of phone it identifies.

MIN versus ESN

The MIN (and IMSI) are subscription identifiers, they do not identify a cellular phone. The ESN (Electronic Serial Number) and IMEI (GSM equivalent) identify the phone itself. When a subscription is changed, perhaps because a phone has been sold or because a different carrier has been chosen, the MIN (or IMSI) must be reprogrammed, but the ESN should stay the same.

The LNP Problem

Local Number Portability, when applied to wireless, will allow an MDN to be retained by a subscriber when changing carriers. This applies even when service is moved from a LEC to a wireless carrier, or vice-versa. Should the MIN be retained, to retain the direct correspondence between MIN and MDN? Or, should it reflect the new carrier?

The CTIA long ago decided that *not* changing the MIN would have a big negative impact on network performance because the MIN is used to identify the HLR when a mobile registers. If the MIN reflects the old carrier, a TIA/EIA-41 query will be sent to the wrong HLR, forcing it to be redirected. Worse, if a customer ports a phone number from a LEC to a wireless carrier, the landline DN cannot be used as a MIN, because it would not identify a valid HLR.

Separating MIN and MDN

Separating the MIN and MDN is easy…except for the book-keeping. Someone has to keep track of MIN and MDN codes independently. Currently, keeping track of phone numbers implicitly does the same for MINs.

The CTIA is proposing to keep the current format for a US MIN – the first 6 digits will be known as the MBI (MIN Block Identifier), and it will be assigned to a carrier by the MBI administrator. The remaining 4 digits will be assigned by the carrier to individual subscribers. By contrast, for the IRM, the first 4 digits are assigned by IFAST, and the other 6 are assigned by the carrier.

This division of the MIN digits increases the amount of book-keeping required by

wireless carriers within the NANP, but it is compatible with the way MIN blocks are assigned today.

Long Term Gain

Although assigning MIN codes separately from phone numbers will be costly and confusing at first, it will have advantages beyond LNP.

Area Code Changes

Area code changes currently force wireless phones to be reprogrammed (except GSM) to maintain alignment between the MIN and MDN. This will no longer be necessary when management of the MIN and MDN are separated. Because phone numbers can be changed at the switch, the cost of area code changes will be reduced for wireless systems.

Global MIN Assignment

Currently, the NANP is sitting on 80% of the MIN resource, the rest of the world has to fight over the remainder. Consequently, this 20% — the IRM resource assigned by IFAST — is more than 50% utilized. Although the CTIA is not recommending this, once the MIN and MDN resources are separated, the North American wireless industry will have access to about 8 billion unique mobile identifiers — far more than is needed. MINs corresponding to landline phone numbers, pagers, toll-free numbers, etc. will be freed for exclusive use by wireless. If the MIN is seen as a global resource, the international shortage of MIN codes would disappear. There is no reason why an international carrier could not be assigned a block of MIN codes corresponding to North American phone numbers, once everyone realizes these two resources are completely distinct.

Administrivia...

The CTIA RFP and supporting documentation can be obtained at:

www.wow-com.com/industry/tech/articles.cfm?ID=305

Responses must be received by the CTIA no later than May 8, 2001 and the contract will be awarded on June 29, 2001.

Status of IS-41 Rev. C & TIA/EIA-41-D (ANSI-41) Implementations

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Intersystem Operations Capability	Alcatel CDMA	Ericsson Analog	Ericsson TDMA	LG CDMA	Lucent Analog	Lucent CDMA	Lucent TDMA	Motorola Analog	Motorola CDMA	NEC Analog	NEC CDMA
Authentication (CAVE)	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔
IS-778 Authentication Enhancements	✔			🕐							
CNAP/CNAR			✔	🧪		🧪	🧪				
CNIP/CNIR	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Data (IS-737)	✔		✔	✔					✔		✔
Inter-MSC handoff: Analog to…		✔	✔		✔		✔	✔		✔	
Inter-MSC handoff: CDMA to…	✔			✔	✔	✔		✔	✔	✔	✔
Inter-MSC handoff: TDMA to…		✔	✔		✔		✔	✔			
International (IS-751 IMSI and IS-807)			✔	🧪		🧪	🧪				
Hyperband handoff (TSB-76)	✔		✔			✔	✔		✔		
LNP Phase I (IS-756)	✔	✔	✔		✔	✔	✔	✔	✔		
LNP Phase II (IS-756-A)		✔	✔					🕐	🕐		
MWN	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔
Origination Triggers	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Over-the-air Activation (IS-725)	✔		🧪	✔		✔	🕐		✔		✔
SMS Origination	✔		✔	✔		🧪	✔		4Q'00		✔
SMS Termination	✔		✔	✔		✔	✔	✔	✔		✔
Termination Triggers	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Voice Privacy - basic			✔	✔		✔	✔		✔		✔
Voice Privacy - EPE											
WIN Phase I (IS-771)	🕐	✔	✔	🧪	🕐	🕐	🕐	🕐	🕐		
WIN Phase II (Prepaid)	🕐			🕐				🕐	🕐		

Status of IS-41 Rev. C & TIA/EIA-41-D (ANSI-41) Implementations

Cellular ***Networking*** ***Perspectives***

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Intersystem Operations Capability	Vendor and Radio Technology					
	Nortel (MSC/BS)			Telos		
	Analog	CDMA	TDMA	Analog	CDMA	TDMA
Authentication (CAVE)	✔	✔	✔	✔	✔	✔
IS-778 Authentication Enhancements						
CNAP/CNAR	⊙	⊙	⊙			
CNIP/CNIR	✔	✔	✔	✔	✔	✔
Data (IS-737)	░	⊙	⊙	░	⊙	
Inter-MSC handoff: Analog to…	✔	░	✔	✔	░	
Inter-MSC handoff: CDMA to…	✔	✔	░	✔	✔	░
Inter-MSC handoff: TDMA to…	✔	░	✔	✔	░	✔
International (IS-751 IMSI and IS-807)	░	⊙	⊙	░	⊙	
Hyperband handoff (TSB-76)	░	✔	✔	░		
LNP Phase I (IS-756)	✔	✔	✔	✔	✔	✔
LNP Phase II (IS-756-A)	⊙	⊙	⊙	**3Q'01**	**3Q'01**	**3Q'01**
MWN	✔	✔	✔		✔	✔
Origination Triggers	✔	✔	✔	✔	✔	✔
Over-the-air Activation (IS-725)	░	✔	✔	░	✔	✔
SMS Origination	░	✔	✔	░	✔	✔
SMS Termination	✔	✔	✔		✔	✔
Termination Triggers	✔	✔	✔	✔	✔	✔
Voice Privacy - basic	░			░		
Voice Privacy - EPE	░		⊙	░		
WIN Phase I (IS-771)	✔	✔	✔	✔	✔	✔
WIN Phase II (Prepaid)	⊙	⊙	⊙			⊙

Notes

Terms: www.cnp-wireless.com/glossary.html.

Symbols:

✔	In field trial or commercial service.
XQ'XX	Specifies the quarter during which commercial availability is expected (e.g. 4Q'01).
🧪	In lab trial.
⊙	Under Development
░	Shading indicates a capability that is not technically feasible at present, or for which no standard yet exists.
Bold type	Company names in **bold type** have indicated a change in status since the last report.
Red	Text and figures in red indicate specific changes since the last report (visible only in electronic edition of newsletter).

TIA TR-45.4/3GPP2 TSG-A

Radio to Switching Technology ("A" Interface) Standards

Cellular *Networking* **Perspectives**

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Note:
1. IS- Interim Standard, TSB- Telecommunications Systems Bulletin, PN- Project Number, SP- ANSI Standards Proposal, A.Pxxxx - TSG-A project, A.Rxxxx - TSG-A report, A.Sxxxx - TSG-A specification.
2. Bold Type indicates a modification since the previous publication of this information.
3. Published TIA standards can be obtained from TIA at www.tiaonline.org/standards/search_n_order.cfm.

Thanks to Steve Jones (MALR) for his assistance compiling the information in this table.

Published Standards

Standard	Project	Description	Status
TIA/EIA-634-B	SP-4277	"A" interface supporting analog, CDMA, SMS, data services, frame relay and 1800MHz PCS	Published 04/99
TIA/EIA-829	**PN-4683**	**Tandem free operation (eliminates intermediate vocoders in mobile-to-mobile calls with compatible**	**Published 06/00**
IS-94		**Mobile Station - Land Station Compatibility Specification for Analog Cellular Auxiliary PCS**	**Published 05/94**
IS-634-0		MSC-BS "A" Interface Standard	Published 12/95
IS-634-A	PN-3539	MSC-BS Interface, including support for IS-95-A, EIA/TIA-553-A, IS-41-C, SMS, data and frame relay	Published 10/98
TSB-80		IS-634-0 Addendum (corrections, SMS, subrate voice frame format)	Published 11/96
TSB-104		PCS Service Description (now IS-104 in committee TR-46)	Published 06/94

Completed Internal Documents

Project	Description	Status
PN-3142	Cellular Microcell/Microsystems Requirements Document	Internal project
PN-3296	MSC-BS Interface (A-Interface) Requirements for Public 800 MHz	Internal project

Active TIA TR-45.4 Projects

Standard	Project	Description	Status
TIA/EIA-634-C	SP-4377	Revision of BS-MSC "A" interface	Project cancelled
TIA/EIA-2001	PN-4546	cdma2000 Access Network Interface (ANSI version)	Ballot
IS-828	PN-4604	BTS-BSC (A bis) interface for cdma2000 systems	Ballot
IS-2001	**PN-4545**	**cdma2000 Access Network Interface ("A" Interface) based on 3GPP2 TSG-A IOS V4.1**	**Published**
IS-2001-A	**PN-4545-RV1**	**cdma2000 Access Network Interface based on IOS v4.2**	**Ballot 02/01**
	PN-3964	Use of A-Interface standards in Wireless Local Loop	Project cancelled
	PN-4276	Fixed Wireless Access (Stage I Description)	On hold pending review by CDG
	PN-4376	**Addendum to TIA/EIA-634-B to Address 3G Extensions**	**Replaced by PN-4545**
	PN-4378	Addendum to TIA/EIA-634-B for TIA/EIA-136-B (TDMA)	Project cancelled
	PN-4379	Addendum to TIA/EIA-634-B for TIA/EIA-95-B (CDMA)	Replaced by PN-4545

Active 3GPP2 TSG-C Projects

Standard	Project	Description	Status
A.P0006	PN-3-0007	IP-based Radio Access Network "A" interface between base station and MSC	Development
A.P0007	PN-3-xxxx	Support for 1xEV-DO (CDMA) between RAN and elements and to the Core Network	Development
A.S0001-A		See IS-2001	Ballot
A.S0001-B		See IS-2001-A	Ballot 02/01
A.S0003-0		See TIA/EIA-829	Ballot
A.S0004		See IS-828	Ballot