Cellular Networking Perspectives

David Crowe [Editor] • Phone: 1-800-633-5514 • Fax: 403-289-6658 Vol. 5, No. 4 April, 1996

In This Issue...

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First Meeting of IFAST

The first meeting of the International Forum on AMPS Standards Technology was held in Dallas, Texas on March 27-28, 1996, with representatives of various trade associations, manufacturers, standards organizations and carriers from the United States, Mexico, Canada, Colombia, Brazil and Russia. The group first agreed to methods of work and membership requirements (both very open) and formalized the appointments of Fred Gaechter of the Bellcore Numbering Consulting Group as chairman and of Bernardo Martinez of Iusacell and Ed Hall of the CTIA as co-conveners (i.e., with administrative responsibility).

A number of technical issues were also discussed:

- The Mexican MIN transition (from a 52 prefix to a 05 prefix), as a mid-term international roaming solution. This may result in Mexican MIN's no longer having any connection to the subscriber's directory number. Other countries that are looking into international roaming may have to find similar solutions.
- The beta test of Mexico/US/Canada international roaming using 05-prefix MINs is on schedule, with completion estimated for July, 1996.
- The AMPS industry's transition to IMSI as a long term international roaming solution. This transition is discussed in detail in the June,1995 issue of *Cellular Networking Perspectives.*
- International coordination of MIN and SID values. A letter will be distributed as widely as possible asking for information on national MIN and SID allocation practices to allow time for as much information as possible to be incorporated in TIA TSB-29 Revision B, scheduled for publication in 3Q'96.
- Problems related to the interconnection of national IS-41/SS7 networks to facilitate seamless international roaming. Further work will be required in the areas of global title translation types and requirements for ITU CCS7 to ANSI SS7 international gateways.

The second IFAST meeting will be held on June 26-27, 1996 at a location in Mexico to be announced. The third meeting is tentatively scheduled for October 3-4, 1996 in San Francisco. Contact Donna Cutshaw of the CTIA (202-736-3224, fax: 202-466-7239) for up to date information on meeting dates and locations, or to be added to the IFAST mailing list.❐

New TR-45 Ad Hoc Groups

Two new ad hoc groups have been formed by TIA committee TR-45 to study OA&M standardization and to coordinate liaison with the ITU (International Telecommunications Union).

The OA&M ad hoc group will study the standardization of Operations, Administration, Maintenance and Provisioning functions in a wireless network based on the AMPS family of standards. Likely a standardized, object oriented protocol (such as TMN) will be used, to act as a middle layer between a customized graphical user interface and the different pieces of equipment that make up the wireless network. This

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ad-hoc group, which will report to TIA subcommittee TR-45.2 is chaired by Huel Halliburton of AirTouch. Mr. Halliburton is also chair of the closely related Wireless Intelligent Network ad hoc group.

The ITU ad hoc group will coordinate the promotion of TIA positions to this organization. This reflects the increasing need for the coordination of TIA standardization activities with other organizations. The "AMPS" standards, while technically only American in scope, have actually been implemented in over 50 countries worldwide. Also, GSM based systems (i.e. PCS-1900) are being installed in North America as TIA-adapted standards. A particular need is to develop an ITU Signaling System #7 global title translation type that will facilitate the exchange of mobility management messages between different countries, particularly when one country transports IS-41 or GSM MAP messages over top of an ITU CCS7 layer and the other uses an ANSI SS7 layer. This ad hoc group will report to TIA committee TR-45 and is chaired by Cheryl Blum of Lucent Technologies (also chair of TIA subcommittee TR-45.2). ❒

TR-46 Implodes

It is not official yet, and it is not even certain, but TIA committee TR-46 that not long ago fought ATIS for position of Grand Poobah of PCS standards, is but a shell of its former self, more easily shelved than revitalized. Many of the participants abandoned ship after all AMPS family standardization for PCS moved to TR-45. The remaining companies seem to have a preference for working within the ATIS T1P1 committee. The three subcommittees (TR-46.1, TR-46.2 and TR-46.3) have gone into dormancy, leaving only ad hoc groups within TR-46.2 and TR-46.3 left to meet during ATIS T1P1 sessions. The TIA now has to determine whether it wants to do the politically correct thing and breath life into TR-46 by working more joint projects with T1P1, get aggressive and assert control over all wireless standards or just take the least cost route and kiss goodbye to the uneasy grouping of unrelated air interfaces and related standards that have found shelter in T1P1 (GSM, PACS, Omnipoint and Broadband CDMA) and let them sink or swim in their own pond. ❒

Wireless'96

The annual CTIA trade show and convention, Wireless'96, was held in Dallas on March 25-27, 1996, bigger, better and louder than ever before, with close to 20,000 people attending. It is impossible to summarize the show, or even to separate the understated from the overhyped, or to distinguish the vaporware and the Oz-demos from the companies about to put a vapor trail between themselves and their competition. The show is so big that it is impossible to both see a selection of the exhibits and attend the choreographed sessions or the panel discussions and presentations. The educational and the commercial components increasingly seem incompatible, unless the show is stretched out longer to minimize the overlap between these two equally important parts.

A few observations are in order:

• Digital

The battle between TDMA and CDMA continues, with CDMA proponents increasingly on the defensive, able to demonstrate working phones, but not able to brag about a commercial beachhead in North America. TDMA proponents can point to IS-136 phones to deflect criticism about voice quality on the first generation of IS-54. But, they also suffer from a lack of commercial experience with this new technology. Will the improved voice quality of the new voice coder really play out in commercial service? A press conference on CDMA was a united front of manufacturers and carriers promising that commercial service is imminent, in the next couple of months, but not convincing on their vague discussions of the problems that have delayed the completion of field trials for so long.

• Voice Recognition

This technology seems increasingly mature, and increasingly in demand. Although, with each vendor claiming to have solved the problems of their competition, concerns about the maturity of the technology only seem more relevant, not less. Unlike the CDMA/TDMA battle, it seems that there is little question that near perfect voice recognition is not far off. Given the safety and convenience aspects of voice recognition for wireless control of dialing and voice mail systems, it can be commercially viable, while still not quite there.

• Data

There were more wireless data solutions on display than ever before, and yet the excitement seems to have dissipated. Perhaps people realize that while combined CDPD/voice terminals might be nice, there is a lot of infrastructure development and applications software required before the much promised explosion of data technology actually occurs.

• Small Systems

Small switching systems for cellular and PCS abound in greater numbers than ever; Plexsys, Celcore, Phoenix, Telos, Harris-NovAtel, NewNet and TeCoRe, often using base station equipment from other manufacturers. Broadband base stations, such as those from Watkins-Johnson, Steinbrecher and AirNet have increased in popularity, using DSPs to allow easier customization to the continuing explosion in air interface standards that are finding some kind of North American niche.

• Intelligent Peripherals

Manufacturers of voice mail systems, and other peripherals, recognize that they must become more integrated with the wireless network. The catchword Intelligent Network abounds. However, with the Wireless Intelligent Network still being defined by the TIA, it is a long way from the day when functionality can be added to cellular or PCS systems by the addition of a cool peripheral, a cable and programming of a trigger in a switch. Face it, no manufacturer is going to admit that they don't participate in the Intelligent Network when the phrase can be made to apply to both the trivial and the profound. ❒

Surfing the NET??

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http://www.cadvision.com/cnp-wireless

Test your knowledge and have some FUN!

Take our quiz...

SIDs, BIDs and Other IDs

This is not a review of a book by Dr. Seuss, nor is it a discussion of Freudian psychology! The acronyms SID, BID, as well as MSCID, MIN, ESN, IMSI and a PC/SSN are all identifiers used within an IS-41 based cellular or PCS network. MIN, ESN and IMSI are individual mobile identifiers while SID, BID, MSCID and PC/SSN identify network elements.

Table 1: AMPS System Identifiers

Category	Identifier	Description
Mobile	ESN	32 bit terminal identifier.
	IMSI	Next generation 15 digit mobile subscription identifier.
	MIN	Current subscription identifier, usually a national phone number.
Network	BID	Identifies a subset of a SID for accounting purposes.
	MSCID	Cellular switch identifier.
	PC/SSN	SS7 network element identifier.
	SID	Cellular or PCS license identifier.

Mobile Identifiers

The MIN and IMSI identify a mobile subscription, with the first few digits of each identifier defining the HLR (Home Location Register) that contains the subscription information. A transition is underway from the traditional MIN to the internationally recognized IMSI.

MIN - Mobile Identification Number

The 10 digit MIN (Mobile Identification Number) is currently used in AMPS cellular, but has limitations for international roaming as it was designed to contain a North American Numbering Plan (NANP) 10 digit directory number (without the NANP 1+ 'country' code). Increasingly, the MIN is being programmed in different ways, with the potential for overlap and consequent ambiguity. Within North America many specialized phones, for both voice and data applications, are being programmed with non-dialable MINs (usually those beginning with a 0 or 1) to conserve directory numbers. Outside North America, MINs are programmed in many different ways, but most often as a dialable number begining with the ITU E.164 country code or as a non-dialable number beginning with the ITU E.212 mobile country code.

IMSI - International Mobile Station Identifier

The 15 digit IMSI (International Mobile Station Identity) facilitates international roaming by identifying the home country and home network of each roaming mobile. IMSI, defined by ITU-T Recommendation E.212 is composed of a Mobile Country Code (MCC), Mobile Network Code (MNC) and a Mobile Station Identification Number (MSIN). This transition to IMSI gained momentum in the last year by the recent publication of two AMPS-based standards that accomodate IMSI as an alternate identifier (IS-136 for TDMA digital cellular and IS-95 for CDMA digital cellular) and by the adoption of IMSI by the US, Canadian and Mexican industry. The TIA standards IS-41 for intersystem operations, IS-124 for call detail record transfer, IS-634 for the BS/MSC interface and IS-91 for analog cellular are currently in the process of being modified. During the transition to IMSI most new cellular and AMPS-based PCS phones will have both a MIN and an IMSI. The IMSI is currently also used in GSM-based wireless networks.

The MIN and IMSI not only identify a specific mobile subscription, but the first few digits also identify the home system. This allows IS-41 messages initiated by a roamer action to be routed to the correct HLR. Also, roamer billing records can be sent to the appropriate home billing system.

ESN - Electronic Serial Number

The ESN identifies a terminal, rather than a subscription, and therefore is always supposed to remain the same (although cloners have obviously figured out how to change them). The ESN is defined to consist of a manufacturer's code, some reserved bits and a serial number (assigned by the manufacturer).

If the difference between a mobile subscription and a mobile terminal is confusing, think of a situation where you need to replace your phone. The new phone will have a different ESN, but by programming it with your old MIN, you will not have to apply for a new subscription. Conversely, if you keep a phone while moving to a different city, the new system would assign you a new MIN along with your new subscription, but your ESN would be unchanged.

The use of bits within the ESN may be modified, to accomodate more manufacturers. Either the manufacturer code field will be expanded to include the reserved bits or the ESN will be expanded. Place your bets on the former approach that requires virtually no modification to standards, phones or network infrastructure.

System Identifiers

SID, BID, MSCID and PC/SSN are system identifiers. Each identifies a geographical service area or a network element. The relationships between the various system identifiers are shown graphically in Figure 1.

SID - System Identification

A 15 bit SID (System Identification) is allocated with each cellular or PCS license by the national communications authority (e.g. the FCC in the USA and Industry Canada in Canada). Digital and analog AMPS cellsites transmit the local SID on their broadcast control channel. A SID is also stored within each phone to identify the 'home' system. Some phones may store more SIDs to identify a list of systems that will give the subscriber 'home away from home' treatment. A comparison of the stored home SID with the transmitted SID allows phones to control their home/roam indicator.

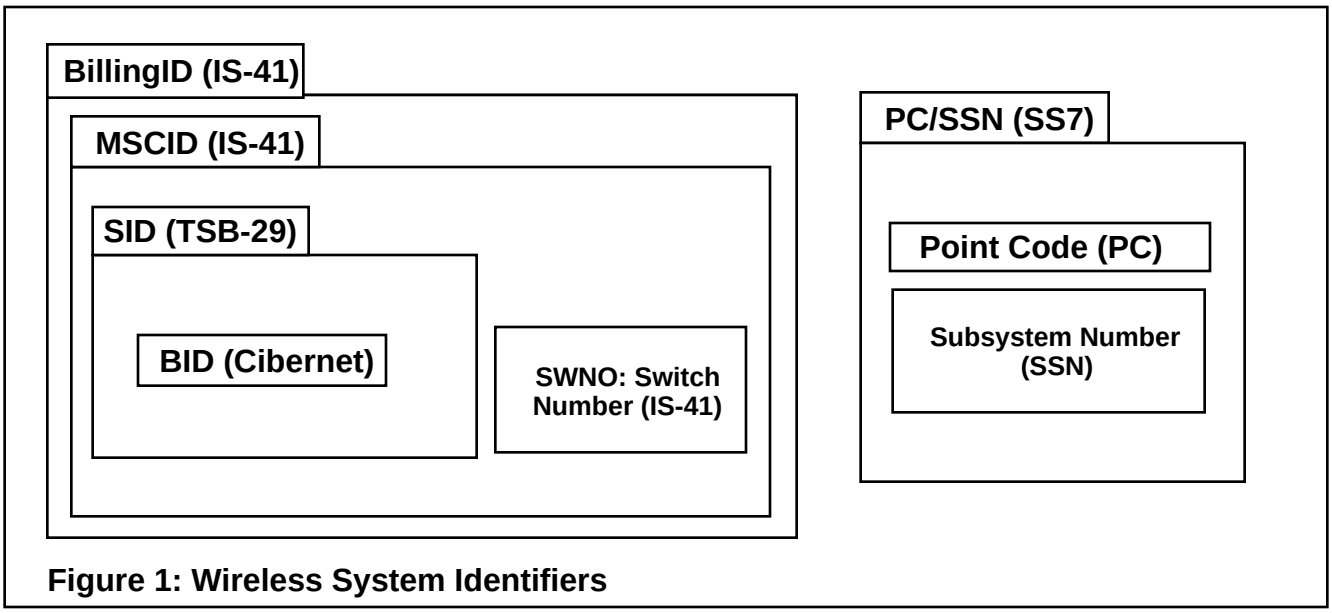

Figure 1: Wireless System Identifiers

There are 32,767 available SIDs. The assignment of SID ranges to countries is defined in TIA document TSB-29 Rev. A. The US, for example, has been allocated SIDs 0-2175 for cellular and 4096-7679 for PCS. Unfortunately, most SID values that can be transmitted have been allocated in TSB-29 to a country, even to countries that are unlikely to ever implement an AMPS system. This could leave countries, such as China, that may potentially implement a huge number of licenses, without enough SIDs to have one per license.

BID - Billing ID

An exception to the allocation of SIDs to countries is the range 26112 through 31103 that are mysteriously reserved in TSB-29 for 'accounting purposes'. These are the BIDs (Billing IDs), that are allocated by CIBERNET Corp. (phone +1–202–785–0081), a subsidiary of the Cellular Telephone Industry Association (CTIA). BIDs are used when it is necessary to segregate the revenue from one part of a single SID system from another part, for tax purposes or other financial or business reasons. A BID is never transmittted by a cellsite, but is overwritten on a SID in a call detail record, when necessary, based on the place within the system that the call took place.

In December 1995, in response to a request from CIBERNET Corp., SIDs from 32768 to 40960 were allocated as additional BIDs. This takes advantage of the fact that SIDs above 32767 cannot be transmitted on a radio interface, but that network protocols generally define the SID as a 16 bit field. The remaining SIDs (40961 to 65535) are reserved. There is a possibility that systems that store the SID as a 15 bit field or network protocols that transmit it that way will not be able to accomodate a 16 bit BID.

MSCID - IS-41 Network Element Identification

An MSCID identifies a single cellular switch or other network element. One part of the MSCID is the SID but, in addition, a Switch Number can be used to discriminate between multiple switches or other network elements within a SID. The MSCID is transmitted in some IS-41 inter-system messages and can be used as an address, although it is not a native address on either X.25 or SS7 networks, so a translation is always necessary. The MSCID is also used within the IS-41 BillingID parameter (not to be confused with BID!) to identify the so-called 'Anchor' system in calls that are extended by inter-system handoff or inter-system paging. This allows multiple call detail records for a single call to be correlated.

PC/SSN - SS7 Network Address

An SS7 network address (ANSI or ITU) is composed of a Point Code (PC) which is the address of a physical SS7 network node and the Subsystem Number (SSN) which identifies an application within the node. PC/SSN identifiers are optionally included in some IS-41 inter-system messages as alternate addresses to MSCID. The PC/SSN does not replace the use of MSCID to identify anchor systems in call detail records. The use of PC/SSN can simplify routing software by IS-41 nodes that use SS7. If PC/SSN is not included in the IS-41 message it can be extracted from lower SS7 layers in most cases. However, in transactions where the address refers to a network node other than the sender of the message, it must be explicitly included.

The use of a PC/SSN address is only defined within a national network. Special addressing, and the cooperation of an international gateway, is required to communicate with a point code in another national network. ❒

TIA TR-45.2
Project Status Report

Editor David Crowe • Phone: 1-800-633-5514 • Fax: 403-289-6658 *Last Published 07/95*

Superseded Interim Standards and TSBs

IS/TSB-	Description	Published
IS-41-0	Cellular Radiotelecommunications Inter-System Operations	02/88
IS-41-A	Cellular Radiotelecommunications Inter-System Operations	01/91
IS-41-B	Cellular Radiotelecommunications Inter-System Operations	12/91
IS-52-0	Cellular Subscriber Dialing Plan and Service Codes	11/89
IS-53-0	Cellular Features Description	09/91
TSB-27	IS-41 Application Notes (never published, date is when released to WG I)	07/89

ANSI Standards

ANSI #	SP #	TIA IS-	Subject	Status
TIA/EIA-660	SP-3544	IS-52-A	Dialing Plan	In press
TIA/EIA-664	SP-3545	IS-53-A	Features	In press
TIA/EIA-	SP-3588	IS-41-C	Intersystem Operations	Approved for ballot

Published EIA/TIA Interim Standards

IS-	Description	Published
IS-41-C	Cellular Radiotelecommunications Inter-System Operations	in press
IS-52-A	Uniform Dialing Procedures for use in Cellular Radiotelephone Systems	in press
IS-53-A	Cellular Features Description	in press
IS-93-0	Ai and Di Interfaces Standard (PSTN/MSC)	10/93
IS-124-0	Cellular Inter-System Non-Signaling Data Communications	09/93

Published Telecommunications Systems Bulletins (TSBs)

TSB-	Description	WG	Published
TSB-29-A	International Implementation of Cellular Systems Compliant with TIA-553	VI	09/92
TSB-41	Technical Notes for IS-41 Revision B	I	11/94
TSB-51	Inter-System Authentication, Signaling Message Encryption and Voice Privacy	I	02/93
TSB-55	IS-41 Rev. A/B Forward Compatibility	I	05/94
TSB-56-A	Application Level Testing for IS-41 Rev. B, IS-53 Rev. 0 and TSB-51	II	06/94
TSB-64	Wideband Spread Spectrum Intersystem Operations	I	02/94
TSB-65	Mobile Border System Problems	I	04/94

Active TR45.2 Projects (PN = TIA Project Number)

PN-	Title	Editor/Chair	WG	IS/TSB
3173	International Implementation of Cellular Radiotelephone	Steve Jones	VI	TSB-29-B
3293	Cellular Inter-System Non-Signaling Data Communications	Kirk Carlson	IV	IS-124-A
3295	Ai and Di Interfaces Standard		VII	IS-93-A
3362	Cellular Features Description (Rev. B)	Terry Watts	I	IS-53-B
3528	Multiple HLR Query ("Double Dipping")	Terry Jacobson	VI	n/a
3579	IS-41 Support for IS-136 (advanced TDMA)	ch: Peter Musgrove	II	IS-41-D
3580	Law Enforcement Intercept Requirements	ch: Peter Musgrove	0	IS-41-D
3581	Enhanced Wireless 9-1-1 Emergency Services	ch: Jeff Crollick	0	IS-41-D
3619	IS-41 Support for IS-95-A (advanced CDMA)	ch: Sam Broyles	II	IS-41-D
3624	PCS Multi-Band Support	Chuck Ishman	III	IS-41-D
3660	Data Services for Digital Cellular	ch:Michel Houde	II	IS-41-D
3661	Wireless Intelligent Network	ch: Huel Halliburton	II	IS-41-D
n/a	Call detail/billing record transfer for data and enhanced services.	Nick Gnesda	IV	IS-124-B

TIA TR-45.3
TDMA Digital
Air Interface Standards

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TDMA Digital Air Interface Standards - First Generation

IS/TSB-	ANSI	Description	Comment
IS-54-B	TIA/EIA-627	Original TDMA Dual-Mode Air Interface Standard	ANSI Ballot #2
IS-55	TIA/EIA-628	TDMA mobile performance standards	ANSI Ballot #2
IS-56	TIA/EIA-629	TDMA base station performance standards	ANSI Ballot #2
IS-85	TIA/EIA-635	TDMA full-rate voice coder (3:1)	In Press (ANSI)
TSB-46		Verification of Authentication for IS-54-B Mobiles	Published 03/93
TSB-47		IS-54 Implementation Issues	Published 05/94
TSB-50		User Interface for Authentication Key Entry	Published 03/93

TDMA Digital Air Interface Standards - Second Generation

IS/TSB-	ANSI	Description	Comment
IS-54-C		***See IS-136***	***Cancelled***
IS-7X		***See IS-136***	***Cancelled***
IS-136-0		**IS-54-B plus Digital Control Channel (DCCH)**	**Published 12/94**
IS-130-0		**Data services radio link protocol**	**Published 03/95**
IS-135-0		**Asynchronous data and fax services**	**Published 03/95**
IS-137-0		**DCCH mobile performance standards**	**Published 12/94**
IS-138-0		**DCCH base station performance standards**	**Published 12/94**
J-STD-009		**Mobile performance standards (PCS Band)**	***In press***
J-STD-010		**Base Station performance standards (PCS Band)**	***In press***
J-STD-011		**IS-136 operation in the 1900 MHz PCS band**	***In press***

TDMA Digital Air Interface Standards - Third Generation

IS/TSB-	ANSI	Description	Comment
IS-136-A		**Enhanced digital control channel (9-1-1, OTA, Calling Name ID, One-button Callback, Private Networks (enhanced), PACA and PCS band operation)**	***In press***
IS-641		**Enhanced full-rate speech codec**	***In press***
PN-3487		**Addendum to IS-137**	***Cancelled***
PN-3488		**Addendum to IS-138**	***Cancelled***
PN-3691		**Addendum to IS-136 Rev. A**	**Development**

Note: 1. IS- Interim Standard, TSB- Telecommunications Systems Bulletins, PN- Project Number, SP- ANSI Standards Proposal, J-STD- TIA/ATIS Joint Technical Committe standard.