Cellular Networking Perspectives

David Crowe [Editor] • Phone 1-403-289-6609 • Fax 403-289-6658 Vol. 7, No. 7 July, 1998

In This Issue...

CALEA Deadline Extended Until October 1, 2000.....p. 1

The CALEA deadline has been extended, but there is still no resolution on Capability, Capacity and Cost issues.

Y2K and Wireless.....p. 1

The CTIA has initiated a plan for testing wireless network elements for Year 2000 compliance.

New Chairman for Analog Standards Subcommittee TIA TR-45.1.....p. 2

John Kay of Motorola discusses priorities for analog standardization.

New Subcommittee for Wireless Network Management Standards: TIA TR-45.7.....p. 2

The Network Management *ad hoc* group is now a full subcommittee.

Enhanced Wireless 9-1-1 (E911), Part III.....p. 2

How is the location of a mobile going to be delivered to the emergency services network? What other 9-1-1 enhancements are being developed?

Status of IS-41 Rev. C and TIA/EIA-41-D Implementations.....p. 5

A summary of the advanced inter-system operation features being developed by major MSC vendors.

TIA TR-45.1 Analog Air Interface Standards Report.....p. 6

A summary of analog cellular standards that have been published by, or that are being developed by TR-45.1

Next issue: August 14, 1998

CALEA Deadline Extended until October 1, 2000

The US congress has extended the date for compliance to CALEA legislation until October 1, 2000. This does not resolve the issue, it merely provides more time for negotiation. In particular, it does not clarify the status of joint TIA/ATIS standard J–STD–025 which the telecommunications industry wants to be accepted as a 'safe harbor' definition of CALEA Capability, but which law enforcement considers to be deficient. Other major outstanding issues are a clear definition of capacity requirements from law enforcement and a desire to extend funding to PCS carriers and others who installed or upgraded switches since the January 1, 1995 funding cutoff date.

Mike Warren, Chief of the FBI's CALEA Implementation Section, has written letters making several complaints about the nature of the process within the TIA ESS (Enhanced Surveillance Services) *ad hoc* group, including the lack of meeting notes. Peter Musgrove, chairman of the TIA ESS *ad hoc* group, on the other hand, has complained about the lack of a clear definition of the FBI's 'punch list' items for standards project PN–4177. A compromise may be in the works following a June 12th letter from TR–45.2 and the *ad hoc* group to the FBI agreeing to a number of changes in procedures, including the provision of official *ad hoc* meeting notes and an "emphasis on facilitating a cooperative spirit among industry and law enforcement participants".

Y2K and Wireless

The year 2000 could be big for the wireless industry. Apart from the previously reported plans for closure of the AMPS system in Australia, and the new deadline for CALEA compliance, there is always the problem of ugly Year 2000 software bugs ("Y2K" problems). The CTIA Advisory Group on Network Interoperability (AGNI) has started the development of a Y2K certification program for MSC's, HLR's and other wireless network elements. The certification testing will also include PSTN interoperability testing. Testing will not be performed on live systems to avoid confusing and inconveniencing customers and billing vendors.

Link Your Company's Website

Our free offer to subscribers is continuing. Let us know your company's website URL, and we will link it from:

http://www.cnp-wireless.com

at no obligation. This will provide a convenient point of departure for searches for wireless information through a categorized listing of premier wireless organizations (i.e. our subscribers).

Earn a Golf Shirt!

You can earn a unique *Cellular Networking Perspectives* golf shirt if someone you recommend becomes a paid subscriber. Send their name and contact information to cnpsales@cnp-wireless.com.

Cellular Networking Perspectives (issn 1195-3233) is published monthly by Cellular Networking Perspectives Ltd., 2636 Toronto Cresc. NW, Calgary AB, T2N 3W1, Canada.
Contact Information: Phone: 1-800-633-5514 (+1-403-274-4749) **Fax:** +1-403-289-6658 **Email:** cnpsales@cnp-wireless.com **Web:** http://www.cnp-wireless.com/.
Subscriptions: CDN$300 in Canada (incl. GST), US$300 in the USA and US$400 elsewhere. Payment by cheque, American Express, MasterCard or Visa.
Delivery: Email or 1st class mail. **Back Issues:** Available individually for $35 in the US and Canada and $40 elsewhere, or in bulk at reduced rates. **Discounts:** Educational and small business discount: 25% off any order. **Copies:** Each subscriber is licensed to make up to 10 copies of each issue or back issue. Please call for rates to allow more copies.

New Chairman for Analog Standards Subcommittee TIA TR–45.1

John Kay of Motorola has replaced Tony Akers (also of Motorola) as chairman of TIA standards subcommittee TR–45.1, responsible for the development of analog cellular standards.

According to Kay his first priority for the committee is to publish "all of the air interfaces that we have balloted in the last year or so [EIA/TIA–553–A, the *core* analog standard, TIA/EIA/-IS–91–A and EIA/TIA–691]. The industry is pretty anxious for the core air interface (ANSI EIA/TIA-553-A) with authentication and the Protocol Capability Indicator."

Charles Teising of Lucent, editor of EIA/TIA–553-A, expects all three analog standards to be approved for publication in early this month (July, 1998).

Following this, Kay has determined that "the next thing is to catch up with the development of analog features that have been occurring in the digital subcommittees, especially TR–45.5, and try to be the central focus for analog compatibility within TR–45. This may involve creating a "common" analog standard that contains all features, including those already developed in TR-45.5 such as PACA and OTA. Going forward TR–45.1 needs to address the higher priorities of the industry. This includes support of the expanded ESN format (ESNX) and IMSI."

"We are also considering how to structure the analog standards. In order to better maintain multiple standards, it has been proposed to remove common sections of the advanced analog standards [IS-91 and TIA/EIA-691], and have them refer to sections within the "core" analog air interface ANSI EIA/TIA-553-A."

"Another work item for TR–45.1 is the development of a vehicular interface for portable cellular and PCS phones." Kay states that TR-45.1 hopes to complete that work this year. "It is unclear right now if this is a closed end project or if there will be [future] revisions."

Page 6 of this issue contains a list of analog standards that have been published by TR–45.1, or are under development. Further information on the expanded ESN and IMSI can be found in the January and February issues of *Cellular Networking Perspectives.*

New Subcommittee for Wireless Network Management Standards: TIA TR–45.7

The TIA TR–45 *ad hoc* group known as the NMAG (Network Management *ad hoc* Group) has morphed into a full subcommittee known as TR–45.7. This subcommittee will "develop wireless network management standards, focused on operation, administration, maintenance and provisioning of wireless network elements and in support of prevailing multi-vendor network environments". This will require considerable coordination between TR–45.7 and other subcommittees, especially TR–45.2 that currently has general responsibility for most network protocols and TR–45.4, which is responsible for the base station to MSC interface.

The chairman of TIA TR–45.7 is Thad Kobylarz of Lucent Technologies.

The first official TR–45.7 meeting will be held in Anchorage, Alaska on August 4th-6th, 1998. A cynic might suggest that perhaps the subcommittee will take a field trip to view the only phenomenon that travels more slowly than standards development: glacial ice. For more information on TR–45.7 contact Billie Zidek-Conner at the TIA by phone at +1–703–907–7706 or by email at bzidekco@tia.eia.org.

Enhanced Wireless 9–1–1 (E911), Part III

The wireless industry is in the midst of the development of standards to support the US FCC Phase II E911 mandate to determine the position of a wireless 9–1–1 caller to within 125 meters. The industry has also initiated a parallel project to define features requested by the emergency services community (led by NENA), including emergency call congestion control, subscriber information and possible emergency call notification. The CTIA also presented the TIA with a Standards Requirement Document intended to improve the rate of 9–1–1 call completion as an alternative to the *Strongest Signal* method.

Note: Due to the developing nature of these standards, the finished product may differ from this description.

Phase II Position (Location)

TIA standards subcommittee TR–45.2 has a project (PN-3890) to develop a standard to meet the Phase II positioning requirements of the FCC E911 Report & Order (CC Docket 94–102). Members of the cellular, ESMR, PCS (including GSM), Emergency and Location industries are participating, although some industry segments also are developing standards elsewhere (e.g. T1P1 for GSM). The FCC mandate requires that the position of a wireless 9–1–1 caller be determined within 125 meters, 67% of the time "Root Mean Square". The meaning of this statement is not clear in the Report & Order, but according to Ed Hall Assistant Vice-President for Technology and Network Operations at the CTIA, the WEIAD, an industry advisory group to the FCC, has agreed that 67% was originally intended to represent a Root Mean Square calculation, and that the requirement should simply be expressed as "125 meters, 67% of the time".

As an aside, we often use the term "position" instead of "location" to avoid confusion with the IS–41 concept of location (e.g. embodied in the Location-Request message) that refers to gross location for call delivery.

The actual job of determining the position of a mobile is left to a number of competing high-tech companies (to be summarized in a future issue). Wireless systems have to interface to selected systems in a (preferably) standard fashion and transport the location information to the emergency services network in a (definitely) standard fashion.

The device interfacing between the position/location network and the wireless network has been assigned the ac-

ronym PDE (Position Determining Entity). Another new network element may route, validate and filter messages passing between the wireless and emergency services network. It has been named MPC (Mobile Position Coordinator).

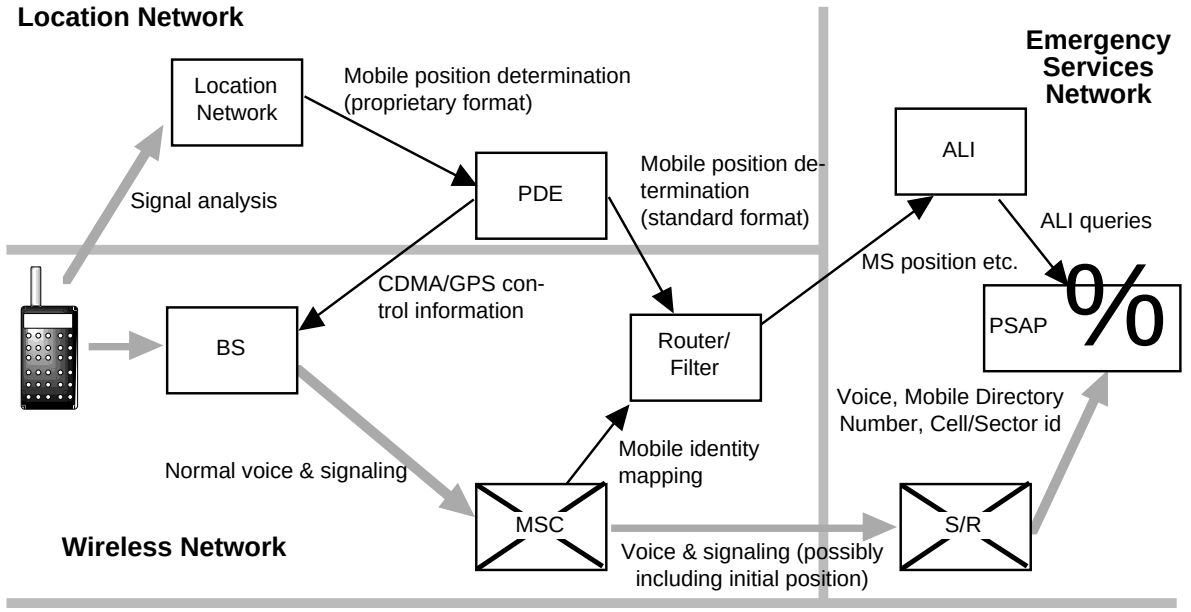
There are three fundamentally different approaches to determining position: network based, mobile based, or cooperative. A network based solution will work for all existing mobiles, and is usually based on multiple measurements using simple geometry to determine the approximate position. A mobile based solution allows the mobile to communicate its position directly to the emergency services network (e.g. a GPS receiver in the handset with synthesized speech to announce the position to the emergency system). A cooperative solution is especially attractive for CDMA systems (for which network based solutions are currently not applicable) requiring some enhancements to the mobile, but centralizing most intelligence (and cost) in the network. One such solution for CDMA, being promoted by Snap-Track, is to place a GPS receiver in the handset, placing most of the logic and signal analysis in the network. A second solution is a Power-Up Function (included in TIA/EIA-95 Rev. B) that commands a mobile to raise its transmitted power level high enough and long enough for network based equipment to get a position fix.

A big advantage of network based solutions is their ability to work with any phone, not just new or upgraded phones. Mobile based solutions allow for a greater variety of technological choices, such as a range of accuracies, but may result in many 9–1–1 callers not being locatable. Cooperative solutions are a compromise, minimizing the cost impact on mobiles, and maximizing the feasibility of mobile phone upgrades, when a network-only solution is not practical.

The location network must be coordinated with the MSC if only to map multiple mobile identifiers (such as MIN, TMSI, IMSI) to the Mobile Directory Number that is used by the emergency network for identification and callback.

Figure 1 illustrates the network elements that are required to support the

Figure 1: A Wireless Network Adapted for Phase II E911



Legend

Voice and in-band signaling

Signaling flow only

(arrows indicate major direction of signaling information flow)

Network Elements

ALI - Automatic Location Identification Database

BS - Base Station

MSC - Mobile Switching Center

PDE - Position Determining Entity

PSAP - Public Safety Answering Point

S/R - Selective Router (E911 Tandem)

delivery of position information. Position information can be transmitted during call setup, shortly after call setup or upon request.

Position During Call Setup

TIA standards subcommittee TR–45.2 has made a proposal to T1S1 to modify the ISUP protocol to include latitude and longitude in the IAM (Initial Address Message) call setup message. The proposal has been reviewed by T1S1, which responded with some relatively minor suggested modifications.

This solution has the big advantage that position is transmitted with call setup. It is therefore the most efficient solution, and makes it easy for a Selective Router (S/R) to use latitude and longitude to intelligently choose the most appropriate PSAP (Public Service Answering Point) to route the call to.

Unfortunately, this solution also has two drawbacks. It is only applicable to systems that interconnect using ISUP common-channel signaling rather than the older (and still common) MF tone based signaling. Also, if position is not available in time it introduces a difficult decision: should a 9–1–1 call be delayed waiting for position to become available? The answer to this question is probably "No", resulting in many calls being forwarded without position.

Position After Call Setup

If the position of a 9–1–1 caller is not available at call setup, it should be sent soon after the call is set up. It has not been determined whether the position will be transmitted autonomously by the wireless system ('pushed') or whether it should be held until the emergency services network requests it ('pulled'). Position information, whether pushed or pulled, could be sent as a follow-up ISUP message via the Selective/Router, as a non-call-associated SS7 TCAP message (similar to IS–41 messages) or as a TCP/IP or X.25 message.

Autonomously sending the position appears to be the best solution at first glance, but it is actually difficult to determine where to send the information, as 9–1–1 calls are often transferred from the original PSAP to another based on the location of the caller or the type of emergency service requested (e.g. fire, police or medical).

Position Upon Request

It may be useful to provide the location of a 9–1–1 caller sometime during a call. The method will be similar to providing initial location following call setup, although care has to be taken to ensure that initial position is not transmitted when current position is needed.

Other Position Services

There may be a market for other services that are based upon position, such as location sensitive billing (e.g. low cost zone around a subscriber's home or office), intelligent 4–1–1 (e.g. closest hardware store to caller) or for tracking trucks, packages or people. These services have a few hurdles to overcome, not the least of which is proof of market demand. If a service involves tracking people, there are also privacy concerns to be overcome (which logically should not be serious if the wireless phone user benefits from the service, and is aware that their location is known). There are also funding concerns. If the 9–1–1 community feels that the installation of a location network will provide commercial services, they may be unwilling to see public funds go towards its development. On the other hand, carriers may be reluctant to invest in location technology without access to 9–1–1 funding, if they are unsure whether location based services will be money makers. The opposite poles of this discussion were well expressed by articles written by Bob Miller in the March 1998 NENA*News* and Jim Nixon of Omnipoint in the June 1998 issue.

Other Capabilities

TIA standards subcommittee TR–45.2 has initiated a new project to develop capabilities requested by NENA, but not mandated by the FCC.

Congestion Control

Although it is important to handle 9–1–1 calls, it is also important to prevent a flurry of calls reporting an accident in one part of a wireless system blocking emergencies in other areas from being reported. Congestion control can be handled by engineering separate groups of 9–1–1 trunks for different groups of cellsites. It does not appear that the standard will require the use of Phase II position information to perform congestion control.

Subscriber Information

Landline E9–1–1 calls provide the PSAP with the name and address of the calling phone subscriber, who is often, but not always, the person making the call. Wireless systems currently provide only the Mobile Directory Number. The simplest additional information that can be provided is the subscriber's name, which can be obtained from databases set up for the Calling Name feature. Other information, including the address and wireline phone number, cannot be obtained from the HLR or other real-time databases, but only from the customer service/billing database, which currently can be accessed only by proprietary protocols.

Emergency Call Notification

Another capability that may be provided is notification of all 9–1–1 calls, including those that are blocked (e.g. by congestion control) or abandoned. Call records may simply be kept by the wireless carrier for future reference, notification may be transmitted only for failed calls, or for all calls.

Enhanced Call Completion

The CTIA SRD on 9–1–1 Call Completion is an attempt to provide a solution to the problem of lack of coverage by the preferred carrier when a 9–1–1 call is placed. The solution may be as simple as bypassing restrictions on bands when making a 9–1–1 call, but only if the preferred system is not available. For example, cellphones programmed as "A-only" could act as "A-preferred" for 9–1–1 calls only, meaning that they would initiate a 9–1–1 call on the B-band only if the A-band was unavailable, not merely because the B-band momentarily had a stronger signal.

Status of IS-41 Rev. C and TIA/EIA-41-D Implementations

Cellular Networking Perspectives

Editor David Crowe • 403-289-6609 • Fax 403-289-6658 First published April 1998

Vendor and Radio Technology

Intersystem Operations Capability	Alcatel			Ericsson		Lucent			Motorola		Nortel		
	Analog	CDMA	TDMA	Analog	TDMA	Analog	CDMA	TDMA	Analog	CDMA	Analog	CDMA	TDMA
Authentication	4	4	4	4	4	4	4	4	4	4	4	4	4
CNAP/CNAR		4Q'98	4Q'98		◷		◷	◷					
CNIP/CNIR		4	4	4	4	4	4	4	4	4	4	4	4
Data (IS-737)					4							⚗	⚗
Inter-MSC handoff: Analog to…	4		4	4	4	4		4	4		4		4
Inter-MSC handoff: CDMA to…	4	4				4	4		4	4	4	4	
Inter-MSC handoff: TDMA to…	4		4	4	4	4		4	4		4		4
IMSI (IS-751)					◷		◷	◷				◷	◷
Hyperband handoff (TSB-76)			4		4		4	4		4		4	4
LNP Phase I (IS-756)	4Q'98	4Q'98	4Q'98	4	4	◷	◷	◷	◷	◷	⚗	⚗	⚗
MWN		4	4	◷	◷		4	4	◷	◷	4	4	4
Origination Triggers	4	4	4	4	4	4	4	4	4	4	4	4	4
SMS Origination		4Q'98	4Q'98		4		◷	⚗				◷	◷
SMS Termination		4	4		4		4	4	4	4	4	4	4
Termination Triggers				◷	◷	4	4	4	4	4	◷	◷	◷
Voice Privacy			4		4		4	4				◷	◷

Glossary

Analog	EIA/TIA-553 or IS-91. Some more advanced features may only be supported for IS-91 phones.
CDMA	IS-95 Code Division Multiple Access digital cellular/PCS radio interface.
CNAP/CNAR	Calling Name Presentation/Restriction
CNIP/CNIR:	Calling Number Identification Presentation/Restriction
Data	Support for data transmissions from digital cellular/PCS terminals when roaming (IS-737).
IMSI	Support for E.212 International Mobile Station Identity (IS-751).
I/S Handoff	Inter-system (i.e. inter-MSC) handoff. CDMA inter-system handoff is always a 'hard' handoff, 'soft' handoff is not supported.
Hyperband Handoff	Inter-system handoff between cellular and PCS bands, or between different PCS bands using TSB–76. CDMA 'soft' handoff between bands is not supported.
LNP Phase I	Local Number Portability Phase I (routing to ported wireline directory numbers) using IS–756. Phase II (not yet standardized) will support ported mobile directory numbers.
MWN	Message (e.g. voice mail) Waiting Notification using audible or visual signals.
SMS	Short Message Service.
TDMA	IS-136 Time Division Multiple Access digital cellular/PCS radio interface.

Symbols:

4	In field trial or commercial service.
XQ'9X	Specifies the quarter during which commercial availability is expected (e.g. 4Q'98).
⚗	In lab trial.
◷	Under Development
	Indicates a capability that is not technically feasible at present., or for which no standard yet exists.

Updates: Please contact the editor by email at crowed@cnp-wireless.com, by phone at +1–403–289–6609 or by fax at +1–403–289–6658.

Editor David Crowe • Phone 403-289-6609 • Fax 403-289-6658

Last published January, 1998

Analog Air Interface Standards - First Generation

Standard	Description	Status
IS-3 (Rev. A,B,C,D)	Original analog air interface standards (see EIA/TIA-553-0)	Rescinded 09/89
EIA/TIA-553 Rev. 0	Analog air interface	Published 09/89
IS-19-B	Mobile minimum performance standards	Published 06/88
IS-20-A	Base station minimum performance standards	Published 06/88
TSB-35	Cellular mobile receiver dynamic range	Published 04/92
TSB-39	Message type assignment for extended protocol	Published 03/93

Analog Air Interface Standards - Second Generation

Standard	Description	Status
IS-88	Narrowband (3:1) analog air interface ("NAMPS")	Published 02/93
IS-89	IS-88 base station performance standards	Published 02/93
IS-90	IS-88 mobile performance standards	Published 02/93
IS-91 Rev. 0	Analog air interface (including "NAMPS" and authentication)	Published 10/94
IS-94	In-building analog air interface ("CAPS")	Published 05/94
IS-680	Residential ("cordless") base station PSTN interface	Published 05/96
TSB-70	Cross reference for FSK control channel	Published
TSB-83-A (SP-3798)	Additional modem options for IS-680 ("cordless")	Published 04/97

Analog Air Interface Standards - Third Generation

Standard	PN- #	Description	Status
EIA/TIA-553-A	**SP-3598**	**Analog air interface (including auth'n, alert/flash with info, abbreviated alert, msg. waiting indicator, protocol capability indicator (PCI) and "core" FSK control channel definition)**	**Post-ballot review**
EIA/TIA-690	SP-3495	Mobile minimum performance standards (prev. IS-19-C)	Second ballot
EIA/TIA-691	**SP-3665**	**Enhanced analog ANSI version of IS-91-A (w/o IS-680 cordless)**	**Post-ballot**
EIA/TIA-712	PN-3597	Base station minimum performance standards (prev. IS-20-A)	Published 09/97
IS-91-A	**PN-3476**	**Revised IS-91 air interface (including IS-94 & sleep mode)**	**Post-ballot**
IS-713	PN-3668	1900 MHz upbanded AMPS (based on IS-91-A)	**Pub. pending**
TSB-70-A	**PN-3610**	**Updated version of TSB-70 cross reference**	**Second ballot**
TSB-71	PN-3477	IS-94 enhancements and issues	Published 10/95

Analog Air Interface Standards - Fourth Generation

Standard	Project	Description	Status
IS-91-B	SP-3666	Revised version of IS-91 (including IMSI, PCS band support,OTA, priority access, 9-1-1, cryptosync & Expanded ESN)	Development
IS-xxx	**PN-42xx**	**Portable wireless phone to vehicle interface: Architecture (PN-4204), Connector (PN-4205), Electrical (PN-4207), Latch (PN-4208) and Test (PN-4209)**	**Development**
	PN-xxxx	**IMSI support in analog air interfaces**	**Development**
	PN-xxxx	**Expanded ESN (56 bit) support in analog air interfaces**	**Development**

Note: 1. IS- TIA Interim Standard, PN- TIA Project Number, SP- ANSI Standards Proposal, TIA/EIA- ANSI approved TIA standard, TSB- TIA Telecommunications Systems Bulletin.

2. **Bold Type** indicates modification since the previous publication of this report.

- Thanks to Bob Slocum of Ericsson, Charles Teising of Lucent and John Kay of Motorola for their assistance compiling this information.