Cellular Networking Perspectives

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Based on the categories you provide, we will create a convenient launching pad for finding information relating to each category of wireless products and services. Many people from all over the world visit our web site, often on a regular basis. Soon there will be one more good reason to do so.

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

In Part I of this article we described the FCC requirements for E911, the surprisingly controversial "Basic" requirements, and the mandatory Phase I requirements. In this issue we complete the discussion of Phase I, with the non-mandatory requirements: Reconnect and Three-Way 9–1–1 Calls.

Phase I Options

The three FCC requirements for E911 Phase I (Callback, Cell/Sector Identification and E9–1–1 Call Routing) were described in the May 1998 issue of *Cellular Networking Perspectives*. Along with these mandatory requirements, Joint TIA/ATIS standard J–STD–034 also defines modifications to support Reconnect and 3-way 9–1–1 calls (see Figure 1). These capabilities are not FCC requirements, but were added at the request of the emergency services community (NENA *et al*).

Reconnect

Reconnect can be viewed as an automatic, wireless-initiated callback, for use when a mobile disconnects due to a radio anomaly (e.g. loss of coverage due to shadowing or signal attenuation due to buildings). If this occurs, the wireless system may re-page the mobile to attempt to reconnect it to the E911 call which is still connected to the emergency services call taker.

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This capability only extends across inter-system boundaries for the case of inter-system handoff. This requires a minor modification to the TIA/EIA-41 intersystem handoff protocol to ensure that the current Serving MSC knows which calls are emergency calls, and therefore that reconnect applies. If a mobile drops off in a cellsite in one system, re-paging will only occur in that same system. Therefore, if the mobile rescans and determines that a control channel in a different system is the strongest available, an attempt to reconnect will fail.

Steps 8 and 9 of Figure 1 sketch the process of Reconnect following an inter-system handoff.

3-way 9–1–1 Calls

It is easy to establish a 9-1-1 call as a 3-way call, by simply dialing 9-1-1 while in a call and pressing SEND (on some systems SEND may have to be pressed twice). This may well be done accidentally instead of on purpose (e.g. by neglecting to END a call before dialing 9–1–1). This capability only applies to subscribers to the 3-way calling feature.

Normally, to establish a 3-way call using the TIA/EIA–664 (formerly IS–53) prescribed method, the mobile user dials digits (e.g. 9–1–1) + SEND to connect to the destination party and put the previous party on hold. A second 'flash' (i.e. pressing SEND without dialing digits) connects all three parties together for three-way conversation.

So far, so good. But the next flash causes a problem. Normally, this flash would disconnect the add-on party. In the case of a 9–1–1 call, this would disconnect the call taker. Consequently J–STD–034 modifies 3-way call processing to ignore this, and any subsequent, flashes. The call will remain in the 3-way conversation state until a party disconnects.

As with Reconnect, the major impact of this feature is to internal MSC call processing. However, 3-way 9–1–1 calling does have a small impact on inter-system handoff – if an intersystem handoff had occurred prior to the 9–1–1 three-way call being completed.

The changes are based on the way TIA/EIA–41 handles a Flash from a mobile following an inter-system handoff. It is not the current serving MSC that processes the flash, it is the Anchor MSC (see the January 1993 issue for more details). This design requires the use of the TIA/EIA–41 FlashRequest message to inform the Anchor MSC that a flash has occurred, and to carry any digits that were dialed (e.g. 9–1–1).

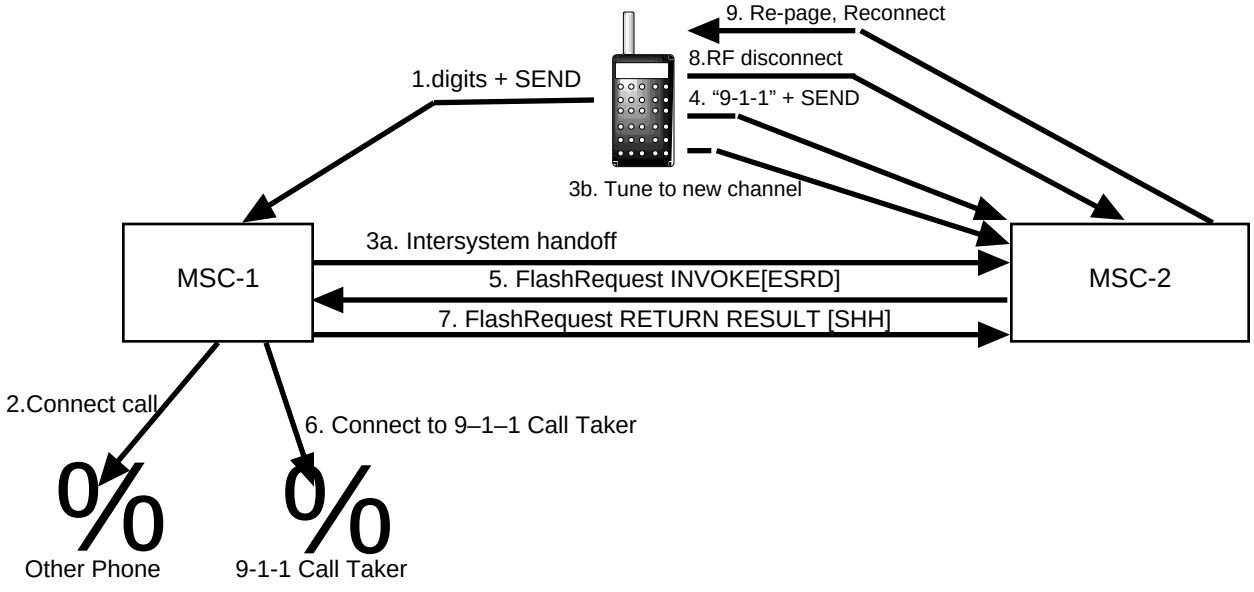
Consequences of this design for E911 are that the Anchor MSC is unaware of the specific cellsite or sector that the call was made from and the Serving MSC is unaware that an emergency call has been made. The first problem is rectified by including the digits that identify the cellsite or sector from which the call was made (known as ESRD; Emergency Services Routing Digits) in *every* FlashRequest INVOKE message from Serving MSC to Anchor. The digits have to be included in every message because (according to the second problem) the Serving MSC does not know that an Emergency call is being made (as the emergency call digits are not always 9–1–1).

The second problem is rectified by identifying the call as an emergency call in the response (the FlashRequest RETURN RESULT from the Anchor MSC back to the Serving MSC) in a new parameter known as SHH (Special Handling). In the case of a 9–1–1 call the special handling that is identified is to make the call eligible for Reconnect.

To be continued…

In the July 1998 issue we will discuss standards to support Phase II of the E911 mandate (more accurate location information).

Figure 1: Inter-system Handoff and E911 Calls



CDMA Standards Progress: TIA/EIA-95-B

The third generation of the CDMA digital air interface standard (cdmaOne) is being balloted by TIA standards subcommittee TR–45.5. The ballot document is known as SP–3693 and will be published by the TIA as ANSI standard TIA/EIA–95–B. It has already gone through an initial round of balloting. No negative ballots were received, but there were numerous comments which TR–45.5 has been working hard to resolve since March 1998. Ballot resolution will be complete by July 1998, at which time the document may be published as is, or reballoted.

TIA/EIA–95–B will combine three distinct elements:

1. The merged text of TIA/EIA/IS–95 Rev. A (cellular, 9.6kbps channels) with TIA TSB-74 (cellular, 14.4kbps channels) and joint TIA/ATIS J–STD–008 standard (1800 MHz PCS). This will provide a single standard for CDMA in both the cellular and PCS bands, offering both 9.6kbps and 14.4kbps voice coder and data operation,
2. New features, and enhancements to existing features (see Table 1),
3. Technical improvements, especialy those designed to improve service, increase capacity or reduce overhead.(see Table 2).

About the Author…

This CDMA standards update was provided by Phil Brown, principal consultant for CISR Inc., providing CDMA and related standards expertise to the wireless industry. Phil has over eleven years of experience in cellular telephony, much with GTE Wireless, in various positions of technical responsibility. He is currently chair of TIA standards subcommittee TR–45.5 Working Group I (User Needs and Services) He can be reached at +1–770–414–9680, or by e–mail at phil.brown@cisr.com.

Table 1: New & Enhanced Features in TIA/EIA-95–B

Feature	Description
CNIP & CNAP	Enhancements to calling number presentation, and ability to display calling name.
Enhanced Roaming Indication	Air interface support to permit network control over phone's roaming indicators, allowing 11 different system types to be displayed from "Premium" partners down to simply "Available".
High Speed Data	64 kbps data transmission in both directions.
Network Directed System Selection	Allows a mobile to be redirected to a more preferred system when roaming.
PACA	Priority Access & Channel Assignment for emergency workers and 9-1-1 callers. The phone will display its position in the queue when waiting for a channel.
Mobile Location	Base station can instruct MS to briefly transmit at a higher power to make it more 'visible'. This technique may meet the FCC E911 Phase II mandate (125 meters).
Wireless Local Loop	Air interface signaling to emulate Parametric Alerting (different ringing styles), Line Control (off-hook, on-hook etc.) and Meter Pulses (for payphone billing).

Table 2: Technical Improvements in TIA/EIA-95-B

Area of Improvement	Description
Call Setup	Handoff during call setup will reduce the number of call setup failures.
CDMA-to-analog handoff	The MS will now search for available analog frequencies instead of executing the handoff blindly.
DTMF signaling	More accurate emulation of user keystroke timing.
Interfrequency hard handoff	Enhancements to reduce dropped calls when an MS is handed off to a different CDMA frequency.
IMSI	Support for IMSI (ITU-T E.212) as a separate identifier from MIN, to enhance international roaming.
MDN	Support for Mobile Directory Number as a separate identifier from MIN, to support Local Number Portability. Used for display only.
Power control step size	0.25 dB output power steps (versus 1 dB previously) to reduce channel interference and improve capacity.
Redirection	Redirection to any CDMA channel in any frequency band.
Soft handoff algorithm	Dynamic threshold algorithm should improve performance and reduce signaling between the MS and BS/MSC.
TMSI	Temporary Mobile Station Identity (for identity confidentiality and signaling optimization).

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Published TR-45.6 Standards

Standard	Description	Published
IS-732 Rev. 0	Standard and System Specification Overview	**02/98**
IS-732-300	Communications Architecture	**02/98**
IS-732-301	Subprofile Concepts	**02/98**
IS-732-310	Application Subprofiles	**02/98**
IS-732-311	Lower Layer Subprofiles	**02/98**
IS-732-312	Subnetwork Subprofiles	**02/98**
IS-732-400	Overview of Airlink	**02/98**
IS-732-401	Airlink Physical Layer	**02/98**
IS-732-402	Medium Access Control	**02/98**
IS-732-403	Mobile Data Link Protocol	**02/98**
IS-732-404	Subnetwork Dependent Convergence Protocol	**02/98**
IS-732-405	Radio Resource Management	**02/98**
IS-732-406	Airlink Security	**02/98**
IS-732-408	Minimum Performance Standards for CDPD Mobile Base Stations	**02/98**
IS-732-409	Minimum Performance Standards for CDPD Mobile End Systems	**02/98**
IS-732-500	Mobility Management	**02/98**
IS-732-501	Mobile Network Location Protocol	**02/98**
IS-732-507	Mobile Network Registration Protocol	**02/98**
IS-732-600	Network Support Services	**02/98**
IS-732-620	Message Handling Service	**02/98**
IS-732-630	Accounting Service and Protocol	**02/98**
IS-732-700	Network Management	**02/98**
IS-732-731	MD-IS and MDBS Management Ensemble	**02/98**
IS-732-732	Inter-Domain Management Ensemble	**02/98**
IS-732-733	Accounting Management Ensemble	**02/98**
IS-732-734	Generic Equipment Management Ensemble	**02/98**
IS-732-750	Management Information Library	**02/98**
IS-732-751	Managed Objects Conformance Statements	**02/98**
IS-732-800	Overview of Supplementary Protocol Information	**02/98**
IS-732-820	State Transition Table for CDPD MAC Procedures	**02/98**
IS-732-821	MAC PICS Proforma	**02/98**
IS-732-830	State Transition Tables for Mobile Data Link Protocol	**02/98**
IS-732-831	MDLP PICS Proforma	**02/98**
IS-732-841	SNDCP PICS Proforma	**02/98**
IS-732-870	State Transition Table for Mobile Network Registration Protocol	**02/98**
IS-732-880	State Transition Table for Mobile Network Location Protocol	**02/98**
IS-732-881	MNLP PICS Proforma	**02/98**
IS-732-900	CDPD -Protocol Testing Overview	**02/98**
IS-732-920	MAC Abstract Test Suite	**02/98**
IS-732-930	MDLP Abstract Test Suite	**02/98**
IS-732-1023	Accounting Summary and Settlement	**02/98**
IS-732-1024	Circuit-Switched - Cellular Digital Packet Data	**02/98**
IS-732-1025	CS CDPD Modem Bank Management Protocol (MBMP)	**02/98**
IS-732-1026	CS CDPD Accounting Service and Protocol	**02/98**

TIA TR-45.6 Cellular Digital Packet Data (CDPD) Standards, cont'd

Published TR-45.6 TSBs

Standard	Description	Published
TSB-87	Overview of Implementor Guidelines	**02/98**
TSB-87-1010	Intermediate System	**02/98**
TSB-87-1012	Network Support Services	**02/98**
TSB-87-1013	Directory Services	**02/98**
TSB-87-1014	Application-Entity Look-up Directory Profile	**02/98**
TSB-87-1015	Subscriber Directory Profile	**02/98**
TSB-87-1018	Authentication Services	**02/98**
TSB-87-1020	Domain Name System	**02/98**
TSB-87-1021	Service Provider Interoperability Test Plan Overview	**02/98**
TSB-87-1022	Parameter Configuration Guidelines	**02/98**
TSB-87-2010	Mobile End System	**02/98**
TSB-87-2011	Mobile Data Base Station	**02/98**
TSB-87-2012	Mobile Data Intermediate System (MDIS)	**02/98**
TSB-87-2013	External Interfaces	**02/98**
TSB-87-2015	Subscriber Identity Module Functional Characteristics	**02/98**
TSB-87-2016	Multicast Perspectives	**02/98**
TSB-87-2018	M-ES EID Assignment	**02/98**
TSB-87-3010	Unique Identifiers Name and Number Plan	**02/98**
TSB-87-3011	Administration of Unique Identifiers Name and Numbering Plan	**02/98**
TSB-87-3012	IP and CLNP Routing Architecture and Addressing Plan	**02/98**

Developing TR-45.6 Standards

Standard	PN/SP	Description
IS-732-A	**PN-4170**	**Standard and System Specification Overview**
IS-732-311-A	**PN-4166**	**Lower Layer Subprofiles**
IS-732-312-A	**PN-4167**	**Subnetwork Subprofiles, including option for IP communication between**
IS-732-500-A	**PN-4168**	**Mobility Management, allowing an intermediate MD-IS in the Location Update Service (LUS)**
IS-732-501-A	**PN-4169**	**Mobile Network Location Protocol, allowing an intermediate MD-IS in the Location Update Service (LUS)**

Note: 1. IS- TIA Interim Standard, PN- TIA Project Number, TSB- TIA Telecommunications Systems Bulletin.

Thanks to Mark Munson (GTE Mobile Communications, and chair of TR-45.6) for supplying information for this report.

Cellular Networking Perspectives

ATIS T1P1 & TIA TR-46 Committees
PCS-1900 ('GSM') Standards
Project Status Report

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Published Standards

Standard	Description	Status
IS-104-A	PCS Service Descriptions	Published
IS-129	Interworking/interoperability between DCS1900 and IS-41 MAPs	07/96
IS-651-0	SS7/GSM "A" Interface (RS/PCSC)	07/95
IS-651-A	**SS7 "A" Interface (RS/PCSC) for GSM systems**	**02/98**
IS-652-0	Intersystem Operations - DCS1900 (GSM) MAP based	05/96
IS-653-0	ISDN "A" Interface (RS/PCSC). Includes SS7 as a transport option.	10/96
J-STD-007	PCS Air Interface Specification	in press
J-STD-015	W-CDMA Air Interface Compatibility Standards for 1.85 to 1.99 GHz PCS Applications	in press
J-STD-023	PCN to PCN Intersystem Operations based on PCS1900 Standard (prev. IS-652)	ANSI pub.
J-STD-024	PCS, SS7 based A-interface Standard (previously IS-651)	ANSI pub.
J-STD-025	**Lawfully Authorized Electronic Surveillance (CALEA)**	**12/97**
J-STD-034	**Enhanced Emergency Services (E911) Phase I (callback, cell/sector identification)**	**12/97**
T1.708.199x	**PCS1900 Service Provider Number Portability**	**Published**
TSB-84	**PCS to PCS Interference Between Licensed Systems**	**10/97**

Standards in Ballot

Standard	PN/SP	Description	Status
J-STD-007-A		Calling Name Presentation supplement to J-STD-007	2nd ballot

Active T1P1/TR-46 Projects

PN	Description	Status
	Determining Location of a GSM Phone	development
	Adaption of GSM A-Interface to PCS-1900	CR to ETSI
	GSM support for 14.4kbps data	CR to ETSI
	PCS 1900 Number Portability Phase II (SMS and other services)	**CR to ETSI**

Note: 1. CR - Change Request, ETSI - European Telecommunications Standards Institute, IS– Interim Standard, J–STD - Joint T1/TIA Standard, PN– Project Number, SP– ANSI Standards Proposal, T1. - Prefix for ATIS T1 ANSI standards, TIA - Telecommunications Industry Association, TSB Telecommunications Systems Bulletins.

2. Published ATIS and TIA standards can be obtained from Global Engineering Documents at 1-800-854-7179 (http://global.ihs.com).

Thanks to Terri Brooks (Nokia) for assistance compiling the information in this table.