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CALEA Crisis Close to Closure?

The crisis over CALEA has apparently come to a boil. The question is who is going to get burned if the pot boils over - industry or law enforcement, or both?

All of the problems with implementation of the US CALEA lawfully authorized electronic surveillance ("wireless wiretap") legislation have one common denominator - money. Whether the topic is Capability, Capacity or Cost Recovery, the fundamental problem is the same. If carriers lean too far towards a strict interpretation of CALEA they risk fines, too far towards a broad interpretation and they risk excessive expenditures on equipment as well as lawsuits from citizens and civil liberties organizations.

Capability

The CALEA legislation references a publicly available standard as 'Safe Harbor', meaning that implementing the standard would put carriers in automatic compliance with CALEA capability requirements. The TIA has been trying to develop such a standard, but law enforcement registered their disapproval by voting against in with about the same number of votes as the industry could muster.

The second attempt at a vote closed on October 28 1997. This time the TIA pursued two ballots in parallel, one ANSI vote (SP-3580-A) that law enforcement has full voting rights on, and one TIA Interim Standard ballot (PN–4116) that restricts the voting rights of law enforcement by requiring paid memberships to the TIA (which they do not have).

The Interim Standard ballot (PN-4116) received 43 votes in favor or "no comment" and only 1 in opposition (Canada's Bell Mobility). 41 ballots from law enforcement will be considered as comments, but not counted as legitimate votes.

The ANSI ballot (SP-3580-A), on the other hand, received 34 votes in favor from carriers and manufacturers and 193 votes in opposition (all from law enforcement)!

Consequently, quick approval of the interim standard is almost a certainty, while the ANSI standard will either get bogged down in ballot resolution, or be declared a failure.

The aim of the wireless industry is now simple: resolve the Capability issue by approving this standard. The CTIA has asked that law enforcement drop its opposition to SP-3580, and the TIA has asked that manufacturers be given an extension to the current Capacity deadline (October 1998) to allow for a normal 2-3 year development cycle following approval of a CALEA standard.

Capacity

A standard by the TIA can only address the *Capability* issue, the final *Capacity* numbers remain to be defined by the FBI. Since CALEA provided separate dates for Capability and Capacity, the industry is currently mandated to provide Capability without Capacity. This

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may be the ability to service one surveillance at each switch, hardly a useful feature! Even if a standard is approved, without the final capacity numbers it will be extremely difficult for vendors to design equipment, and impossible to estimate carrier costs.

The aim of the wireless industry is simple - to get the Capacity and Capability dates aligned, effectively pushing out the implementation date for CALEA by up to three years. The TIA has stated that, although a minimal capability could be implemented by the year 2000, meaningful capability will have to wait until the new capacity deadline, probably in the year 2001.

Cost Recovery

The CALEA legislation specifies that carriers will only be subsidized for CALEA *capability* for equipment installed by January 1, 1995. This obvoiusly excludes most PCS carriers. Due to the delays in defining both Capability and Capacity, the CTIA has asked that the cost reimbursement cutoff be moved to the date on which the standard is finalized.

The CTIA also asked that law enforcement "acknowledge that the cost of *capacity* [emphasis added] is to be borne by law enforcement". This roughly translates to the cost of software being borne by the carrier (unless covered by the capability reimbursement) and the cost of hardware being borne by law enforcement, although some software costs may be related to capacity, and some hardware costs may be related to capability.

Compromise?

It is hard to know what will happen next. However, given that both sides - industry and law enforcement - are getting heat from US Congressional Committees, it would not be surprising to find fresh talk of a compromise. While dates may be extended, they will probably not be pushed as far out as industry would want.

Calling Party Pays: Has its Time Come?

The FCC released a Notice of Inquiry (FCC 97-341) on the subject of Calling Party Pays (CPP) on October 24 1997, following an ongoing CTIA initiative to investigate this capability that was kicked off with the July 1997 release of a white paper entitled *The Who, What, and Why of "Calling Party Pays"*.

CPP is simple to describe; when a mobile receives a call, the airtime charges are paid by the caller, rather than by the called mobile. However, it is harder to implement, as this billing treatment is the reverse of the situation for most cellular and PCS subscribers in the US today, although limited trials and commercial service of CPP do exist. US West probably has the most experience with this feature.

CPP is commonly available for cellular subscribers in other countries. In many, it is the way charging works for all incoming calls, the American billing model is not even available as an option. In these countries, the ratio of outgoing to incoming calls is close to 50:50, rather than the 80:20 split commonly found in the US and Canada. In some of these countries (Israel is often used as an example), the monthly usage is also considerably higher.

CPP has some unique problems to overcome in the US. Currently, most wireline phone users do not pay for local calls, making the cost differential between a local call and a CPP call greater than in other countries. Also, it will be difficult for revenue to be collected for several types of calls, including payphone and hotel calls. In other cases, such as calls from residential or business phones, the major challenge will be calculating the cost of a call in one place (e.g. the wireless system) and billing to a caller on another system (e.g. a LEC or competing wireless carrier).

The FCC is interested in finding out whether CPP would allow wireless services to compete more effectively with wireline. The CTIA is interested because it believes that CPP will increase the airtime usage of wireless consumers. They expect the 80:20 outgoing/incoming ratio to be changed not by calls moving from the outgoing to the incoming category, but by a large increase in additional calls. Their aim is to get consumers to leave their phones on much more of the time.

Responses to the FCC NOI must be received by December 1, 1997.

Disclosure: The editor, David Crowe, is performing some work on CPP under contract to the CTIA.

Roaming with the IS-136 TDMA Digital Control Channel (DCCH), Part II

The October issue of *Cellular Networking Perspectives* provided an overview of the IS–730 network standard that allows roamers to take advantage of some advanced "Digital Control Channel" (DCCH) features of the IS–136 second generation TDMA radio interface standard. Features described included the User Group "extension phone" capability and the System Operator and Base Station Manufacturer Codes. We have obtained since then an up to date list of national SOC assignments, which provides a useful list of the major declared TDMA carriers (see Table 1). A similar list of BSMC assignments illustrates some of the major IS-136 base station manufacturers (see Table 2). Some carriers and some manufacturers may have chosen not to be listed if they are not planning on providing any SOC-specific or BSMC-specific features. We have also learned that AT&T Wireless, Ericsson and Nokia jointly support a simple over-the-air mobile programming feature that relies on recognizing the AT&T Wireless SOC code.

In this issue, we discuss some further features of the DCCH that are supported by IS-730: Control Channel Mode Monitoring, Sleep Mode, alternate Voice Coder support and the PSID/RSID "Virtual System" Concept.

The IS-136 Digital Control Channel (DCCH) is described from an air interface perspective in the August and Sep-

Table 1: National SOC Assignments

Country	Carrier	SOC
US	AT&T Wireless Services Inc.	1
	Bell South Cellular	3
	Southwestern Bell Mobile Systems	4
	Vanguard	7
	Century Cellunet	8
	Pacific Telecom Cellular	9
	Midwest Wireless	10
	Rural Cellular Corporation	11
	Cellular Mobile Systems of St. Cloud	12
	Palmer Wireless, Inc	14
	Sygnet Wireless	15
	Liberty Cellular	16
	Wireless One	17
	Mobitel	18
	Mercury Cellular	19
Puerto Rico	Cellular Communications of Puerto Rico	13
Canada	Rogers Cantel Inc.	2
	Bell Mobility	5
New Zealand	Telecom Mobile Communications Limited of New Zealand	1

tember 1995 issues of *Cellular Networking Perspectives*.

Control Channel Mode (CCM) Monitoring

Advanced DCCH features require that the mobile be registered on a DCCH. A mobile could easily be registered in a system which only has DCCH support on some cells. Consequently, the HLR might try to invoke terminating features (such as user group terminations) that would fail if the mobile happened to be registered on the "analog" control channel at the time. IS-730 allows the serving system to report the Control Channel Mode (CCM: either Analog or Digital) to the HLR. While there is certainly a benefit to this feature, it also has the drawback that it requires additional RegistrationNotification messages to report this change in mobile status. This drawback will be insignificant in systems that have full DCCH coverage as, in this case, the serving system only has to report the Control Channel Mode on the initial registration.

Sleep Mode Support

IS-136 terminals can go into a mode, commonly called "Sleep Mode", where the mobile shuts off most of its electronics, waking up only periodically to see if there is anything for it to do. Obviously, the serving system has to synchronize with the mobile. This only impacts intersystem operations when intersystem paging is required, usually when Border Cell problems are encountered (see the May, June and July 1996 issues for more information on this topic). In this case, the Paging Frame Class (PFC: how long to snooze between periods of consciousness) must be transmitted to any border systems, to allow them to initiate a page only at the right interval. This will slightly delay call termination for the lowest PFC value (1.28 seconds), but for most of the higher values (up to 123 seconds), it is probably not even worth bothering to page, because the delay would be greater than most callers would put up with.

Alternate Voice Coder Support

The biggest criticism of the original TDMA IS-54 systems was the quality of the VSELP voice coder. Many people considered VSELP unacceptable, especially when a phone was being used in a noisy environment.

IS–136 Revision A supports a second voice coder (defined in TIA/EIA/-IS–641). This alternate coder, which also runs as a "full rate" coder (i.e. using 2 out of the 6 available timeslots), has minimal impact on intersystem operations. Only inter-MSC handoff messages have to be modified, to allow a transition from the IS-641 voice coder to the VSELP coder, if the target MSC does not support both coders.

The PSID/RSID "Virtual System" Concept

TDMA proponents heavily promote the in-building capabilities of the IS-136 TDMA standard. These rely on the concept of a Private System Identifier (PSID) that provides a virtual "system within a system" giving wireless PBX or Centrex capabilities. Also, to provide a "cordless" capability for residential customers, IS-136 provides a Residential System Identifier (RSID). A system can provide a menu of up to 16 PSID's or RSID's on the DCCH. First a mobile can pick one that it likes and determine whether it is available. If it is, it can present the name of the virtual system to the user, who can choose whether to access it, or to try another.

The main benefits of virtual systems are in billing and services. Businesses and residences may be billed at a lower rate for airtime when they are using one of the cells in their virtual system (which for a residential customer, would likely be one cell). However, this can be accomplished without the PSID/RSID

Table 2: BSMC Assignments

Base Station Manufacturer	BSMC Code
Lucent Technologies	1
Ericsson	2
Hughes	3
Motorola	4
Nokia	5
Harris	6
Northern Telecom	8

concept. All that PSID/RSID adds is the ability for the user to see the name of the virtual system that they are registered on, which may indirectly tell them the airtime rate they will be paying.

Services may also be different for virtual systems. Likely, abbreviated PBX-like dialing would be supported for business customers. Dialing a 3, 4 or 5 digit number would connect to the appropriate extension on the corporate PBX. However, this can also be provided without the use of the PSID/RSID concept, as the system can easily tell from the individual profile of a user whether they have special group or individual features in certain cells.

The technical benefit of the PSID/RSID concept boils down to visibility. Customers can be shown which system they are in, which enables them to make more informed decisions about using their phone. A marketing advantage is that the name of the virtual system can be displayed, providing a better illusion of a standalone private system.

A unique, but luckily optional, characteristic of the PSID/RSID concept is that the phone user can choose which system to access, if more than one virtual system would agree to provide them service. However, it is hard to believe that this would appeal to anybody except the occasional technologically sophisticated skinflint. Having to help your phone decide which system to pick every time your phone registers would be seen as an annoyance by most cellphone users.

Telling a PSID from an RSID

A PSID differs from an RSID mainly in the way it is identified. While an RSID is always carrier specific (i.e. based on a single SOC code), the PSID can be market specific (based on SID), carrier specific (based on SOC), national (based on Mobile Country Code, MCC) or international. In effect the SID, SOC or MCC act as an extension to the PSID (or RSID) number. Consequently, a mobile will never recognize an RSID from another carrier, even if it has the same identifying number as its personal RSID. Similarly, a SID-specific PSID will never be recognized by a mobile operating in a system broadcasting a different SID. The RSID is then based on a large number (up to 65,534) of virtual systems for special local services within one carrier's domain, while a PSID can, if desired, be extended arbitrarily. Theoretically, a worldwide company could obtain a PSID that would provide special services worldwide wherever IS-136 systems are available.

Registering in a Virtual System

The process of registering in a virtual system, illustrated in Figure 1, consists of several steps:

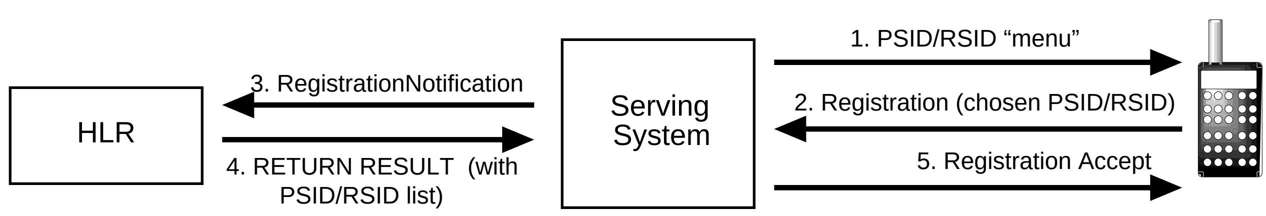
1. The Serving System continually broadcasts the menu of up to 16 PSID's and RSID's that it supports in its System Identification message (along with its SID, for public access) to all mobiles.
2. The mobile picks a DCCH that is advertising a PSID or RSID that it is interested in, and submits an IS-136 Registration message, including the identity of the PSID or RSID that it wants to register in.

   If more than one of the PSID's and RSID's supported by the mobile are also supported by the DCCH, the mobile can go into a much more complex procedure, known as "Test Registration" to determine which it would be allowed to register in. This requires a human interaction, to pick one of the available choices, two more air interface messages (Test Registration and Test Registration Response) and two IS-41 messages (QualificationRequest INVOKE and RETURN RESULT).
3. If the mobile has not been previously registered, the serving system sends an IS-41 RegistrationNotification INVOKE message to the HLR.
4. The response to the message (RETURN RESULT) contains a list of PSID's and RSID's that the mobile is allowed to access. It also contains user zone information (see below).
5. The serving system can now respond to the registration request from the mobile. Note that it has to wait until this point to respond, because there is no guarantee that a mobile has the right to access a PSID or RSID that it attempts to register in. If registration is refused, the mobile can try another PSID or RSID, or can try registering as a public user (i.e. without a PSID/RSID).

User Zones: An Abstraction of the PSID/RSID Concept

IS-730 contains a new abstract concept, the User Zone, that is an attempt to simplify management of complex clusters of PSID's and RSID's. A User Zone is a single identifier that represents a group of PSID's. However, the translation from User Zone to PSID is not defined in IS-730, and would thus require busi-

Figure 1: Virtual System Registration using PSID/RSID



ness agreements and a non-IS-41 method of updating thedistributed database. This capability would only be useful if a significant number of phones have access to multiple PSID's and RSID's. Otherwise, it is easier and more efficient to deal directly with the PSID/RSID concept. In fact, if the PSID implementation is managed properly, there should be no reason for a mobile to have more than a handful of PSID's and RSID's (e.g. one RSID for home use and one national PSID for corporate use).

Managing the Mobile's Database: PSID/RSID Uploads

IS-136 assumes that mobiles have a PSID/RSID database so they can make intelligent decisions about which virtual systems to attempt to access. As the world does not stand still, however, this database will have to be updated occasionally. This capability is not strictly a part of IS-136 Revision A, but was included in the Over-the-Air Activation Teleservice (OATS). This capability, which rides on top of the IS-136/IS-41 short message service, allows the PSID/RSID list inside a mobile phone to be updated any time the mobile is powered on, but not in a call.

The acknowledgement to the PSID/RSID upload is carried in the MSInactive message, rather a strange choice, since it can only be sent when the mobile becomes inactive after the upload. If a mobile registers in another system, no acknowledgement can be sent. Also, the transaction is acknowledged within the OATS layer, so the MSInactive acknowledgement is superfluous as well as unreliable.

Modifications to IS-41 Messages

Table 3 summarizes the modifications to IS-41 Revision C messages that are defined by the IS-730 standard. Note that IS-730 was constructed against IS–41 Revision C, and not against ANSI standard TIA/EIA–41.

Table 3: IS-730 Modifications to IS-41 Messages

Message	Purpose	Modifications
FacilitiesDirective2	Inter-MSC handoff forward	SOC, BSMC, alternate voice coder
HandoffBack2	Inter-MSC handoff back	SOC, BSMC, alternate voice coder
HandoffMeasurement Request2	Pre-handoff mobile signal strength measurements	Measured terminal capability
HandoffToThird2	Handoff path minimization	SOC, BSMC, alternate voice coder
InterSystemPage	Page neighbor without inter-MSC facilities	CCM, PFC (for sleep mode), terminal type
InterSystemPage2	Page neighbor with inter-MSC facilities	CCM, PFC, terminal type
MSInactive	Report MS state change	PSID/RSID download status
Qualification Directive	Provided updated profile, validation information to serving system	CCM
QualificationRequest	Obtain profile, validation information from HLR	CCM, User Group, PSID/RSID data
Registration Notification	Register mobile in serving system & obtain profile, validation information	CCM, User Group, PSID/RSID data
RoutingRequest	Set up call delivery	CCM, User Group
SMDPP	Short message delivery	PSID/RSID download (OATS teleservice)

Conclusions

Many IS-136 DCCH features are most useful in a closed environment (e.g. wireless PBX) - such as User Group and PSID/RSID. Use in a wide area roaming environment, as defined by the IS-730 standard, is less likely. A major advance is that an IS-136 system can provide more information to the mobile station regarding the status of the current serving system, and even display this to the user. This both has benefits to the user and marketing advantages to the carrier. The Sleep Mode feature and new voice coder are also of great significance to users of IS-136 phones.

Acknowledgements

I would like to thank John Diachina (Ericsson), Lee Valerius (Nortel), Sharat Chander and Peter Nurse (Lucent) and Terry Watts (Southwestern Bell Mobile Systems) for their assistance in unraveling the mysteries of IS-730 and the DCCH.

TIA TR-45.5 CDMA Digital Air Interface Standards

The table on page 6 summarizes the standards published by TR-45.5 to define and support CDMA Digital Cellular, as well as those under development.

Abbreviations used in this table include:

IS-	TIA Interim Standards
J-STD-	TIA/ATIS Joint Technical Committee standard
PN-	TIA Project Number
SP-	ANSI Standards Proposal number
TIA/EIA-	Prefix used for an ANSI standard (versus TIA/EIA/IS- for an interim standard).
TSB-	TIA Telecommuniations Systems Bulletin.

We would like to acknowledge the assistance of David Ott (OKI) and Dr. Ed Tiedemann and Sam Broyles (Qualcomm) with obtaining the information in this table.

TIA TR-45.5 CDMA Digital Air Interface Standards

CDMA Digital Air Interface Standards - First Wave (Cellular)

Standard	Description	Publication
IS-95	**CDMA Dual-Mode Air Interface Standard (Authentication Appendix Nov.'92)**	Published 07/93
IS-96	CDMA Option 1: Voice Coder	04/94
IS-97/IS-98	Base Station/Mobile Station minimum performance standards	12/94
IS-126	Service option 2: Loopback	12/94

CDMA Digital Air Interface Standards - Second Wave (Cellular & PCS)

Standard	PN/SP	Description	Publication
IS-95-A		**IS-95 Revised (Authentication Appendix "A" Nov. 1994)**	05/95
IS-96-A		CDMA Voice Coder	12/94
IS-97-A		Base Station minimum performance standards for IS-95-A	07/96
IS-98-A		Mobile minimum performance standards for IS-95-A	07/96
IS-98-A-1	PN-3867	**Errata and additional tests for IS-95 mobile stations**	**09/97**
IS-99		**Data Services (9.6kbps Fax and Circuit Switched Data)**	07/95
IS-125		Voice coder minimum performance standards	05/95
IS-126-A		Mobile station loopback service option	07/96
IS-637		Short message service (rate set 1)	12/95
J-STD-019	SP-3383	Base station minimum performance standards	***Pending***
J-STD-008	SP-3384	IS-95 adapted for 1800 MHz frequency band	***Pending***
J-STD-018	SP-3385	Mobile minimum performance standards (for J-STD-008)	***Pending***
TSB-58		Parameter value assignments	12/95

CDMA Digital Air Interface Standards - Third Wave (Cellular & PCS)

Standard	PN/SP #	Description	Publication
IS-127		Option 3: enhanced variable rate voice coder (EVRC)	01/97
IS-127-1	PN-xxxx	Revision to IS-127	Development
IS-657		**Packet data services (Internet, CDPD)**	07/96
IS-658		Data inter-working function interface (e.g. modem pool)	07/96
IS-683	PN-3569	Over the air activation and service provisioning	02/97
IS-683-A	PN-3889	OTA update: Roaming system selection and programming lock	Development
IS-683.A		**Authentication/Encryption Annex "A" for IS-683**	**03/96**
IS-707	**PN-3676**	**14.4 kbps data services (including asynch. data, fax, STU-III and packet data)**	**Ballot review**
IS-707-A	PN-xxxx	Revision to IS-707 to be consistent with TIA/EIA-95 capabilities	Development
IS-718	PN-3648	Minimum performance standards for EVRC voice coder	V&V
~~IS-719~~	~~PN-3682~~	~~Bit exact description for EVRC (IS-127)~~	see IS-718
IS-733	PN-3972	High rate CDMA voice coder (13 kbps)	**Ballot**
IS-96-B		CDMA Voice Coder (8 kbps)	07/96
IS-736	PN-3973	**Minimum performance specification for IS-733**	**V&V**
TIA/EIA-126	**SP-xxxx**	ANSI version of IS-126 (MS loopback option)	Development
TIA/EIA-95	**SP-3693**	IS-95 for 800 MHz and 1800 MHz frequencies (including J-STD-008)	**V&V**
TIA/EIA-95.A		**Authentication/Encryption Annex "A"**	**Development**
TIA/EIA-96		CDMA Voice Coder (8 kbps)	**Development**
TIA/EIA-97	**SP-3814**	Minimum performance standards for base stations	ANSI ballot
TIA/EIA-98	**SP-3815**	Minimum performance standards for mobile stations	V&V
TSB-58-A	**PN-xxxx**	**Parameter value assignments**	**12/95**
TSB-74		14.4 kbps radio link protocol and inter-band operations	12/95
TSB-79	PN-3823	IS-637 update for 14.4kbps SMS, service negotiation and Year 2000	02/97