Cellular Networking Perspectives

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Erratum: CALEA Deadline Not Extended (yet)

The US government has *not* extended the date for compliance to CALEA legislation until October 1, 2000 as reported in our July issue. The House of Representatives did pass the bill, but it has not yet received final approval.

The Editor in *Cellular & Mobile International*

An article by David Crowe entitled *Amputating AMPS in Australia* was published in the July/August issue of the Intertec publication *Cellular & Mobile International*. It describes the political and technical issues surrounding the planned closure of the analog AMPS system in Australia in favor of 3 GSM digital systems, plus future digital PCS systems in auctioned spectrum. It is an expansion and update of an article published in the February 1998 issue of *Cellular Networking Perspectives.*

IFAST: Progress on International Roaming Problems

The most recent International Forum on AMPS Standards Technology (IFAST) meeting was held in June, 1998. A large number of International Roaming MIN blocks were assigned, and the first SID block assignment made. An effort is being made to reclaim SID blocks that are not being used and a new international roaming issue is rising to prominence - TLDN handling.

IRM Assignments

IRM's are MIN codes with an IFAST-assigned 4 digit prefix, beginning with the digit 0 or 1, that globally identify mobiles, facilitating international roaming. IFAST assigned IRM's to carriers from Brazil, Israel, Japan and Peru at their June meeting, as well as to global mobile satellite carriers Globalstar and Iridium. A third category of IRM users includes US companies using IRM codes to identify data terminals (including Aeris, Cellemetry, and carriers supporting UPS package truck modems). Concern is growing that this resource will be exhausted by the demands being placed upon it before widespread implementation of IMSI can relieve the pressure.

A complete list of IRM codes that are known to be in use can be found at the IFAST web site:

http://www.ifast.org

SID Assignments

The SID is a code that uniquely identifies a wireless system that conforms to the AMPS analog standard (TIA/EIA-553 or TIA/EIA/IS-91) or that conform to a CDMA and TDMA standard that has an AMPS compatibility mode (e.g. IS–95 or IS–136). While individual SID codes should be assigned by national communications authorities, blocks of SID codes have traditionally been allocated by the TIA TR–45.2 standards subcommittee. That group recently relinquished their responsibility to the IFAST, which assigned their first

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SID block to Globalstar, for use in their gateways.

A complete list of SID codes that are known to be in use, along with a list of known SID conflicts, can be found at the IFAST web site:

http://www.ifast.org

SID Reclamation

SID codes were first allocated in blocks, by TIA subcommittee TR–45.2, to every country known at that time, based on their perceived needs. Many of those countries actually have no need for SID codes (e.g. they use exclusively GSM, TACS and NMT systems) or were allocated too large a block. Also, a number of countries have been reorganized politically since then, and it is not clear which portion of the country controls the SID codes. IFAST will be attempting to communicate with authorities in all of these countries to determine whether any SID codes can be returned for allocation to countries that need them.

TLDN Troubles

The TLDN (Temporary Local Directory Number) is used by TIA/EIA–41 to allow call delivery through the PSTN. These numbers have traditionally been national directory numbers (e.g. 10 digit numbers within the North American Numbering Plan), making international call delivery difficult. On a temporary basis it is often possible to recognize a TLDN allocated by an international roaming partner (for example, a TLDN of the format 52+8-digits is recognizable as a Mexican number … but only until the US allocates more area codes beginning with 52).

TIA/EIA–41 provides a solution, by identifying a TLDN as national or international (i.e. in the E.164 format). However, the transition to this new format is difficult because IS-41 Rev. A and B systems ignore the international format bit, and will often mishandle the call.

An interesting idea was introduced at the IFAST meeting by a representative of Tele-2000 of Peru. Between several South American countries TLDN's are transmitted in an IRM format. At first this seems nonsensical because IRM codes are non-dialable, non-routable numbers. However, they possess the desirable property of global uniqueness, and they can be transformed from the IRM format to a directory number format through a process of stripping and prefixing digits, something that can be handled by most switches without software modification (although extensive digit analysis tables may have to be developed).

This concept may facilitate international call delivery until TIA/EIA-41 can be upgraded to resolve the compatibility problem (e.g. by MSC's communicating their ability to use the international format).

Next IFAST Meeting

The next IFAST meeting will be held on October 27-28, 1998 in Cabo San Lucas, Mexico. Contact Lori Messing at the CTIA (202-785-0081 or Imessing@ctia.org) for more information.

Segmentation: Breaking Up Is Hard To Do (if you want to get it together again).

TIA/EIA–41 messages for wireless intersystem operations have been getting longer and longer with each revision of the standard, as new parameters are added to messages. While the TCAP encoding used by TIA/EIA–41 imposes no real limit on the sizes of messages, the transport protocol does. In particular, SS7 allows a maximum of around 250 bytes (octets) for data encapsulated by the mandatory MTP layer. If the optional SCCP layer is included (e.g. for global title translation), the maximum length of a TIA/EIA–41 message would be considerably less than this (around 220-240 octets).

TIA standards subcommittee TR–45.2 has initiated a project (PN number not yet assigned) to provide a solution by segmenting TIA/EIA–41 messages into pieces that are small enough to be handled by the transport layer, with the recipient of the segments being able to put them back together again.

Choosing a Method

Several different methods for segmentation were investigated, including message-specific segmentation, a new TCAP layer and use of SCCP segmentation. Each has unique benefits and drawbacks that were considered before SCCP segmentation was accepted.

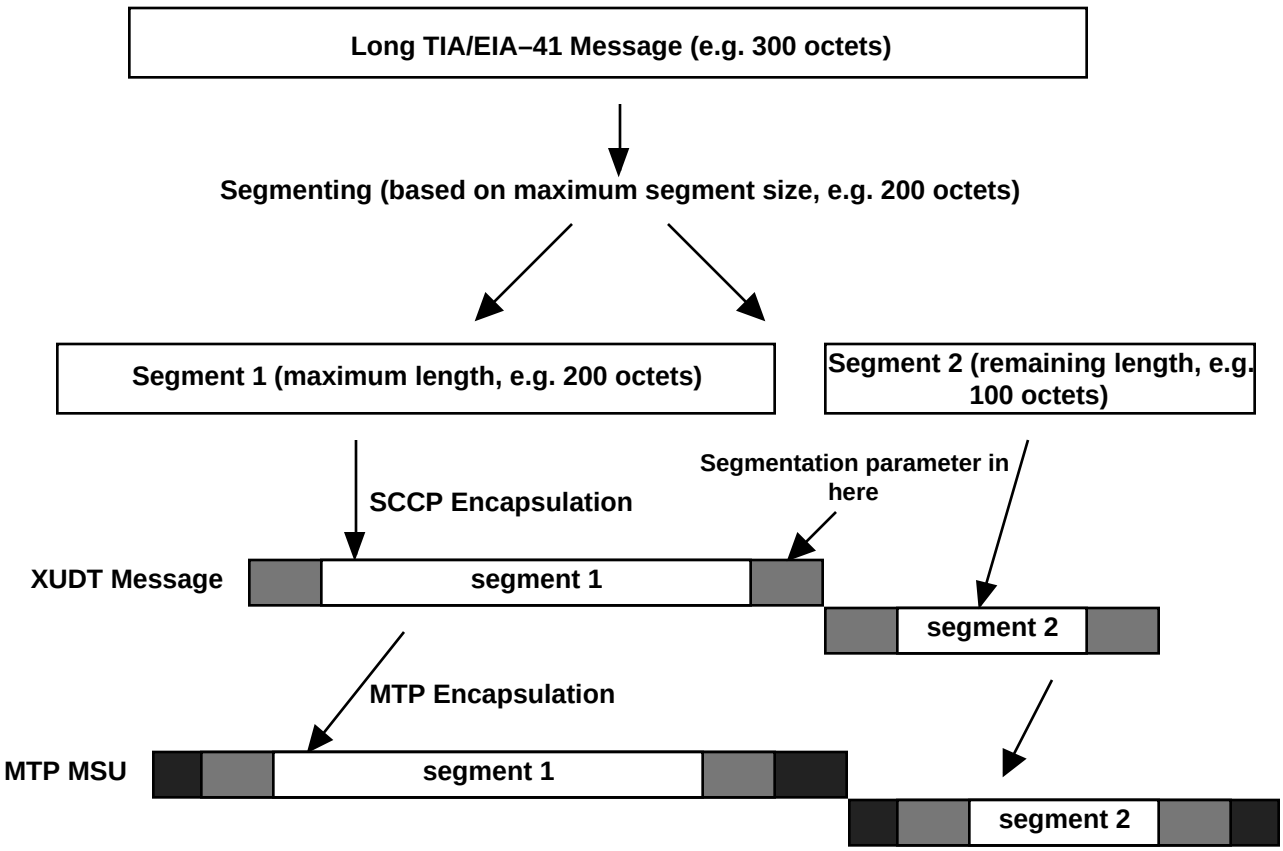
Message-Specific Segmentation

Recognizing that only a few TIA/EIA–41 messages need to be segmented, one proposal was that multiple messages be used to carry segmented information. For example, consider a RegistrationNotification RETURN RESULT message (regnot) containing a large profile. A QualificationDirective INVOKE (QUALDIR) could be used to carry some of the profile information that would not fit in the regnot. This method promised a higher level of compatibility, but foundered because it did not work in enough situations (short message service, for example) and it could cause the very compatibility problems that it was attempting to avoid. In the regnot/QUALDIR example it is possible, for example, that the information in the QUALDIR would not be appended to the regnot profile, but would completely replace that information, resulting in only a partial profile being stored at the Serving VLR/MSC. Furthermore, it would be very difficult, if not impossible, to segment large parameters using this method.

New TCAP Layer

A second approach that was investigated was to introduce a new TCAP layer, in addition to the existing TIA/EIA–41 MAP (Mobile Application Part). This has the advantage that all MAP messages could be segmented without support from the SS7 network. However, the creation of a new TCAP application layer would be a significant standardization effort, and would have significant impact on existing application soft-

Figure 1: TIA/EIA–41 Segmentation Using SS7 SCCP



ware. Also, multiple TCAP layers may be beyond the capabilities of some parsers.

SCCP Segmentation

The SS7 SCCP (Signaling Connection Control Part) layer supports segmentation, and therefore appears to be the most obvious choice (see Figure 1). However, it is only supported by the 1996 revision of SS7 and there is only limited backward compatibility with the 1988 and 1992 revisions. TIA subcommittee TR–45.2 was unable to choose a method, and so requested that the CTIA AGNI (Advisory Group on Network Issues) make a decision. They decided that SCCP segmentation would be best, and that the compatibility issues could be overcome.

SCCP segmentation is implemented through the use of a new message – Extended Unit Data (XUDT), an extension of the Unit Data Message (UDT) that was traditionally used by SCCP to carry application messages. The Segmentation parameter included in this message identifies which segment is being carried (up to 16 are allowed) and also contains a 3 octet message identifier to allow the segregation of segments related to different messages.

The use of the new XUDT message (not available at all in 1988 SCCP) may result in recipients completely ignoring information contained in this message. This causes two types of compatibility problems, one when the recipient of a large message cannot handle segmented messages, and another when an intermediate Signal Transfer Point (STP) does not pass the segments through correctly.

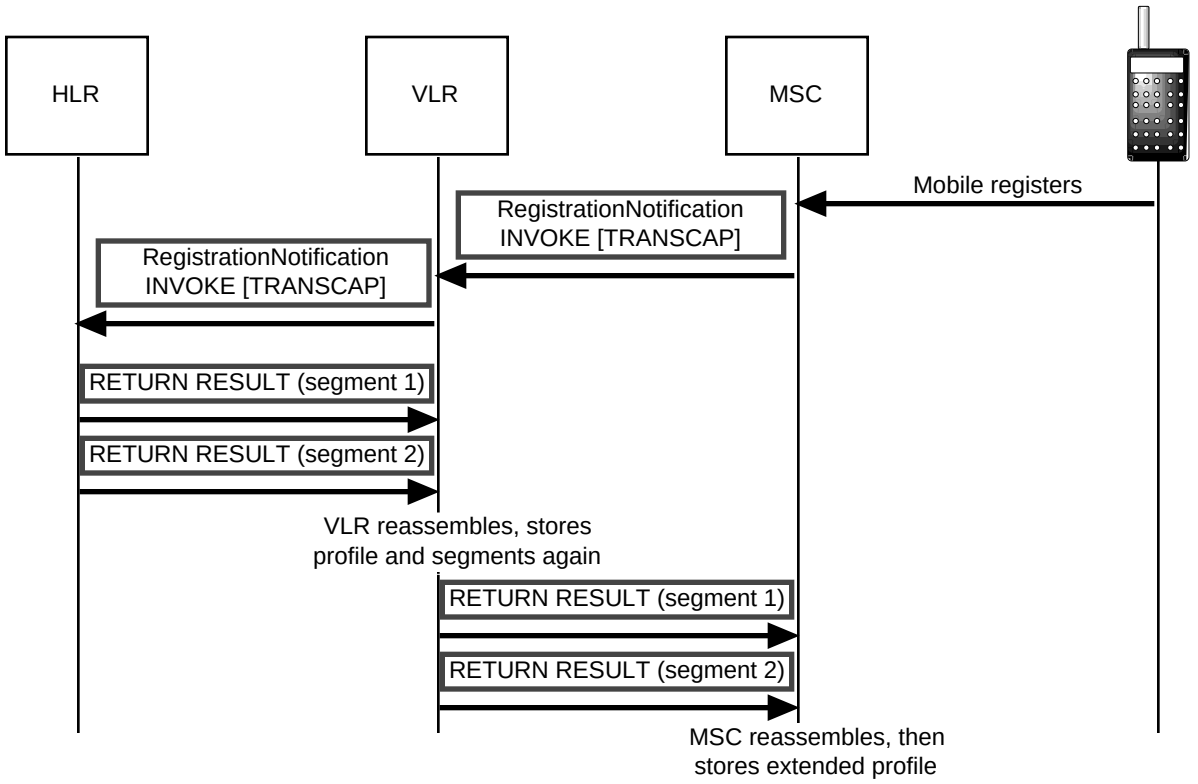
Compatibility concerns for the message recipient can be handled in several ways:

- Addition of a new Segmentation & Reassembly (S&R) capability in the existing TIA/EIA–41 TransactionCapability parameter in certain INVOKE messages to allow subsequent messages to be segmented.
- Addition of the TransactionCapability parameter to TIA/EIA–41 messages that do not currently contain it, to allow segmentation of responses.
- Inclusion of S&R capability in the *neighbor* tables that are required for inter-system handoff.

Compatibility concerns for intermediate nodes can be handled by:

- Not using global title translation for routing, avoiding the need for STP's to open up the SCCP layer.
- Updating all STP's to the 1996 version of SS7. Note that this requirement would extend, in the US and Canada, to all STP's on any SS7 network that handles wireless traffic and, with international roaming, to other interconnected national

Figure 2: Segmentation of RegistrationNotification RETURN RESULT



SS7 networks as well.

Remaining Challenges

Several challenges remain before segmentation of TIA/EIA–41 messages can be widely used:

- Segmentation must be robust even though the maximum segment size may vary from destination to destination. A single maximum segment size that works to all destinations would be useful (a *minimum maximum*, if you like).
- Segmentation must work even when the maximum segment size changes during the transmission of a message, possibly also through the definition of a standard maximum segment size.
- International segmentation interworking must be verified. National SS7 protocols outside ANSI may not perform segmentation in the same fashion. ANSI SS7 is, however, aligned with the ITU SS7 methodology.
- Reasonable alternative actions must be defined for situations when segmentation is known to be unavailable by a message recipient, and when a message is lost in the network or returned with an error due to the unexpected unavailability of segmentation.
- Segmentation of initial messages (e.g. RegistrationNotification INVOKE) is not possible. Although this is not currently necessary, if it is required in the future, further enhancements to the segmentation methodology will be required, such as two stages of registration or storing S&R capability in the *roamer agreement* tables.
- SCCP segmentation neatly handles the potential problem of segmentation of individual parameters (such as long short messages (sic)) because it segments without regard for the TIA/EIA–41 TCAP parameter boundaries.

Summary

Segmentation of TIA/EIA-41 messages will allow continued expansion of transactions to support yet more roaming features and capabilities. Figure 1 illustrates the process of segmentation, using the Segmentation parameter in the SCCP layer. Reassembly is the reverse process, using the Segmentation parameter to ensure that all segments are present, and assembled in the correct order. Reassembly can occur even when the segments are received in a different order than they were transmitted in.

Figure 2 illustrates a simple TIA/-EIA–41 transaction requiring segmentation of the response to a registration message. In this case the subscriber has a large profile that does not fit within SS7 constraints. Note that once the mobile is registered, subsequent HLR-to-Serving System transactions (such as QualficationDirective) can be segmented based on the TransactionCapability parameter in the initial Registration-Notification INVOKE message.

Superseded Interim Standards and TSBs

IS/TSB	Description	Published
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
IS-124-0	**Cellular Inter-System Non-Signaling Data Communications**	**11/93**
TSB-29-A	International Implementation of Cellular Systems Compliant with TIA-553	09/92
TSB-41	Technical Notes for IS-41 Revision B	11/94
TSB-51	Inter-System Authentication, Signaling Message Encryption and Voice Privacy	05/93
TSB-55	IS-41 Rev. A/B Forward Compatibility	05/94

ANSI Standards and Annexes

ANSI #	SP #	TIA IS-	Subject	Published
TIA/EIA-41	SP-3588	IS-41-C	Intersystem Operations	12/97
TIA/EIA-660		IS-52-A	Dialing Plan	09/96
TIA/EIA-664		IS-53-A	Features	09/96
J-STD-025-A	**SP-3580A**	**J-STD-025**	**Lawfully authorized electronic surveillance**	**ANSI review**

Published TIA/EIA Interim Standards

IS-	Description	Published
IS-41-C	Cellular Radio Telecommunications Intersystem Operations	02/96
IS-52-A	Uniform Dialing Procedures for use in Cellular Radiotelephone Systems	03/95
IS-53-A	Cellular Features Description	04/95
IS-93-0	Ai and Di Interfaces Standard (PSTN/MSC)	12/93
IS-124-A	Cellular Inter-System Non-Signaling Data Communications	09/97
IS-725	IS-41 support for Over-the-air Service Provisioning (OTASP)	12/97
IS-728	**Inter-System Link Protocol**	**04/98**
IS-730	IS-41 support for IS-136 DCCH (TDMA digital control channel)	10/97
IS-735	**IS-41 support for IS-95-A (advanced CDMA)**	**02/98**
IS-737	**IS-41 support for data services for digital terminals (TDMA and CDMA)**	**05/98**
IS-751	**TIA/EIA-41 support for IMSI (International Mobile Station Identity)**	**02/98**
IS-756	**Wireless Number Portability, Phase I (database query)**	**04/98**
IS-764	**Calling Name Presentation/Restriction (CNAP/CNAR)**	**06/98**
J-STD-025	Lawfully Authorized Electronic Surveillance (joint with ATIS T1)	12/97
J-STD-034	**Enhanced Emergency Services (E9-1-1), Phase I: identify mobile and cell/sector location**	**12/97**

Published Telecommunications Systems Bulletins (TSBs)

TSB-	Description	Published
TSB29-B	International Implementation of Wireless Systems	10/97
TSB29-B-1	**TSB29-B updates following IFAST #6**	**03/98**
TSB29-B-2	**TSB29-B updates following IFAST #7**	**06/98**
TSB56-A	Application Level Testing for IS-41 Rev. B, IS-53 Rev. 0 and TSB-51	06/94
TSB-76	PCS Multi-Band Support	09/96

Balloting TR-45.2 Projects (PN = TIA Project Number)

PN/SP	Description	Status	Standard
PN-3661	**Wireless Intelligent Network**	**Ballot**	**TIA/EIA-41**
SP-3295	**Ai and Di Interfaces Standard**	**ANSI ballot**	**TIA/EIA-93-A**
SP-3816	**Call detail/billing record transfer for data and enhanced services (e.g. WIN)**	**ANSI ballot**	**TIA/EIA-124-B**

Developing TR-45.2 Projects (PN = TIA Project Number)

PN/SP	Description	Editor	Standard
PN-3362	Cellular Features Description (Rev. B)	Terry Watts	TIA/EIA-664-B
PN-3590	Intersystem Operations	Terry Watts	TIA/EIA-41-E
PN-3890	**Enhanced 9-1-1, Phase II (125 m. location accuracy)**	**Terri Brooks**	**J-STD-034-A**
PN-4081	Authentication enhancements	Nick Mazzarella	TIA/EIA-41-E
PN-4104	Broadcast/Multicast Short Message Service	Michel Houde	TIA/EIA-41,-664
PN-4117	International Implementations of Wireless Systems	Steve Jones	TSB-29-C
PN-4173	**Over-the-air activation addendum**	**S. Somisetty**	**IS-725.1**
PN-4177	**Law enforcement support beyond CALEA (ESS)**	**Mike Hammer**	
PN-4186	Wireless Number Portability, Phase II: portable mobile directory numbers	Chuck Ishman	IS-756
PN-4197	**Internationalization of TIA/EIA-41 (beyond IMSI)**	**Charles Teising**	**IS-xxx**
PN-4206	**PSTN interconnect (including number portability, 9-1-1 Phase II location and Calling Party Pays)**	**David Crowe**	**TIA/EIA-93-B**
PN-4284	**Expanded ESN (Electronic Serial Number)**	**Chuck Ishman**	**TIA/EIA-124 & TIA/EIA-41**
PN-4285	**Calling Party Pays**	**David Crowe**	**TIA/EIA-124 & TIA/EIA-41**
PN-4287	**Wireless Intelligent Network (WIN) Phase II: charging capabilities, etc. - User Description**	**Terry Jacobson**	**TIA/EIA-664**
PN-4288	**Enhanced 9-1-1, Optional features (congestion control and subscriber information)**	**Terri Brooks**	**J-STD-034-A**
PN-4289	**WIN Phase II - Protocol Definition**	**Terry Jacobson**	**TIA/EIA-41**
PN-xxxx	**TIA/EIA-41 Message Segmentation**	**Lee Valerius**	**TIA/EIA-41**

Note:
1. IS- Interim Standard, J-STD- Joint ATIS/TIA Standard, PN- Project Number, SP- ANSI Standards Proposal , TSB– Telecommunications Systems Bulletins.
2. **Bold Type** indicates modification since previous publication.
3. Published TIA standards can be obtained from Global Engineering Documents at 1-800-854-7179.