Cellular Networking Perspectives

Editor David Crowe • Phone 403-289-6609 • Fax 403-289-6658 Vol. 4, No. 2 February, 1995

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Next issue due: March 1, 1995

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Comments Welcome

We welcome comments on the contents and format of this newsletter, suggestions for future topics, letters, submissions and corrections.

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TR-45.2 Standards Update

IS-41 Rev. B Technical Notes (TSB–41, SP-2985) •In Press.

Cellular Dialing Plan (IS-52 Rev. A, SP-3166) • Due to formatting problems in the 'final' version, a further review will occur before IS-52 is submitted to the TIA for publication.

Subscriber Features (IS-53 Rev. A, PN-2977) • A revised version, incorporating approved ballot comments, has been prepared. Following review and approval it will be submitted to the TIA for publication.

IS-41 Revision C (PN-2991) • IS-41 Revision C is in the pre-ballot Verification & Validation (V&V) phase, although not all baseline text is available. Balloting is still scheduled to start in March, 1995.

International Applications (TSB–29 Rev. B, PN-3173) • The mobile identification standard for future cellular terminals will be made at a TR45 meeting later in February. WG VI will be studying this and other issues, and plans to complete TSB-29 Rev. B by January, 1996.

Subscriber Features (IS-53 Rev. B, PN-3362) • A list of features (45 so far) is being accumulated and prioritized by carriers.

DMH (IS-124 Rev. A, PN-3293) • Potential revisions to the "DMH" standard for online transfer of call detail records are being accumulated.

IS-41 Rev. D • A workplan is being developed for the next revision of IS-41, incorporating many of the IS-53 Rev. B features. See the December, 1994 issue for a list of items under consideration.◊

Equal Access Dialing Transition

One of the ways that a long distance carrier can be selected, on cellular systems that support Equal Access to long distance carriers, is by 10-XXX dialing, where XXX represents the 3 digit Carrier Identification Code (e.g. 288 for AT&T and 333 for Sprint). 10-XXX is usually used as a prefix to long distance dialing (e.g. 10-XXX-0/1-403-289-6609 to call us).

Surprisingly, the 1,000 3 digit Carrier Identification Codes (CIC's) are nearly all used up, and a transition is starting this year to 101-XXXX dialing, allowing, eventually, 10,000 long distance carriers to be accessed. Unfortunately, there is a fly in the ointment: how is a poor switch to know the meaning of digits starting with 101? Are they the start of a 10-1XX sequence or 101-XXXX? To resolve this conflict, thirty 3 digit CIC codes have been reserved to allow a gradual transition: 10X, 15X and 16X. During the transition period, any dialing starting with 1010, 1015 or 1016 will be interpreted as 101-XXXX dialing, with 101-0XXX assigned specifically to mirror the existing XXX codes (e.g. 10-123 will be treated the same as 101-0123). All other dialing starting with 10 will be treated as 10-XXX dialing. After the transition period, 10-XXX dialing will no longer be allowed and all 10,000 4-digit CIC codes will be available.

If you still do not have a headache, more gory details of this transition can be found in Bellcore document TR-NWT-001050 (April 1991), available from Bellcore at 1-800-521-CORE.◊

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SMS: Cellular Short Message Service

A major new feature in IS-41 Revision C will be the ability to send short numeric or text messages to cellular phones, fitting somewhere between paging and e-mail in its capabilities and functionality tradeoffs. This new messaging service may significantly reduce the number of people that carry both a cellular phone and a pager, but will not likely encourage a stampede of pager users (see box).

Readers are warned that this description of IS-41 SMS is based on standards committee working documents. Minor or major changes may occur before publication of this standard. At that time, an update will be published in this newsletter.

Time to Throw that Pager Away?

Will SMS make a dent in the pager market? SMS does have some advantages over pagers:

- Longer messages (over 200 characters).
- Two way service (replies and acknowledgements)

These advantages may be especially significant for those who already use a cellular phone, especially when combined with the increased battery life when the mobile is in sleep mode (yet still able to receive SMS messages) and possibly only incremental service and usage charges.

However, to those that only own a pager, there will still be deficiencies:

- Shorter battery life (days instead of weeks, even when cellular sleep mode is used).
- Larger size and weight.
- Higher service and usage charges.

In summary, the market for SMS will not be all pager users, but only those that also use a cellular phone.

Network Reference Model

SMS requires the addition of two new entities to the TIA network reference model and new responsibilities for several others. Figure 1 shows the network entities relevant to short message service. Bold lines indicate new interfaces and narrow lines modified interfaces:

MC Message Center
This new network entity stores and forwards short messages. It tracks the mobile and handles all mobile-terminated messages. Some mobile originated messages may bypass the MC. The MC may have connections to data networks that are not standardized by TR-45.2 (e.g. TCP/IP - internet protocol).

SME Short Message Entity
This new entity may originate and/or receive a short message. It may exist inside a mobile station, another cellular network element (e.g. MSC) or in any other interconnected data network.

HLR Home Location Register
This existing network node stores SMS subscriber profile information and routes messages from visited systems to the appropriate MC.

VLR Visitor Location Register
This existing network node will have to handle SMS message traffic from subtending MSCs and from HLRs.

MSC Mobile Switching Center
This network entity controls the air interface that will be used to send or receive short messages.

An MSC may send mobile originated short messages directly into a data network without passing through the mobile's MC.

Network Protocols

Short messages will probably be first carried within the cellular network using the existing SS7 network. However, assuming that SMS is successful, the level of traffic will rise to a point that will interfere with more time-critical network traffic, such as voice call processing messages. Eventually, SMS traffic may be moved to more suitable networks, such as the famous TCP/IP (internet) network.

Sharing, Sharing, Sharing

IS-41 short message service is economical because of the savings from sharing terminal and network infrastructure between voice and SMS. This sharing introduces some subtleties into SMS. For example, the SMS SME and Mobile Station (MS) share a mobile identification number (MIN) and directory number (DN). This allows some operations based on these identifiers to be provided at little extra cost for short messages. This is not uniformly good, however. The sharing of MIN works well for location tracking, but does not work for mobile availability monitoring, as an MS may be un-

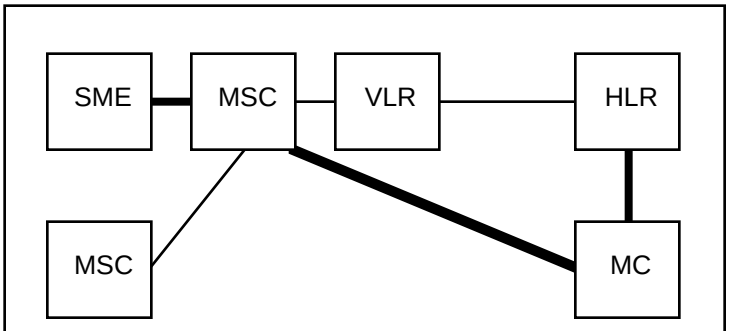


Figure 1: IS-41 Network Reference Model

available to receive a voice call while its SME is available for incoming short messages (e.g. when in sleep mode). As another example, messages directed towards a MC using the MIN as an address will end up at the HLR. This forced the TR-45.2 standards sub-committee to choose between a new SS7 global title translation type (with significant STP management impact) or routing all such messages unnecessarily through the HLR (with additional network and HLR processing impacts).

In summary, it is the sharing that makes SMS a feasible add-on service to cellular. An awareness of the idiosyncrasies that it causes is useful to ensure the most effective implementation.

Message Processing

The basic message processing for SMS involves three basic capabilities: Location Tracking, Mobile Termination and Mobile Origination:

Location Tracking

Location tracking for SMS builds on the foundation already laid for regular cellular phones. When a mobile registers in a system (and both the visited system and mobile are SMS capable) the normal IS-41 RegistrationNotification message sent to the HLR contains a local SMS address that can be used by the Message Center to directly route short messages to the visited system. This address is similar in purpose to the TLDN allocated for every inter-system voice call delivery. The exchange of a temporary routing address creates efficiencies by avoiding each SMS packet passing through the HLR and VLR. Location tracking is illustrate in Figure 2.

Mobile Termination

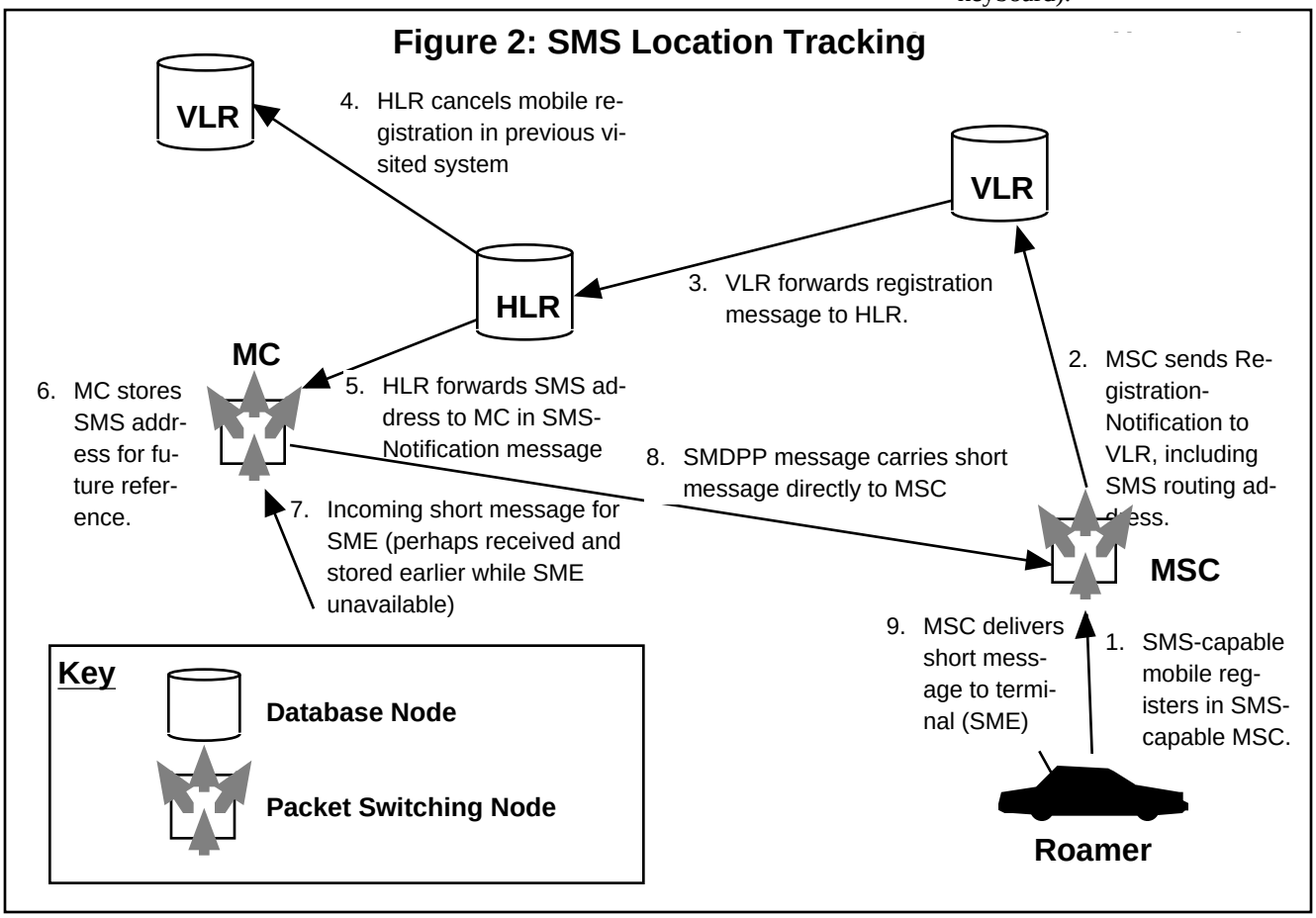
Most SMS messages will be sent to a mobile, not received from a mobile. Once the location of an SME is known, message delivery is quite simple (see Figure 2). The MC simply packages an incoming short message in an IS-41 SMSDeliveryPointToPoint (SMDPP) message and sends it directly to the MSC that the SME is visiting.

Mobile Origination

Mobile origination of short messages is of questionable value, for two reasons:

a. Mobile keypads generally have awful capabilities for alphabetical character entry. Consequently, a balance will have to be made between user inconvenience (the status quo numeric keypad with awkward alphabetic entry) and larger and more complex user interfaces (e.g. a PDA at the extreme, or at least a QWERTY keyboard).

Figure 2: SMS Location Tracking



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Analog Air Interface Standards

Standard	Description (not the official title)	Comment
TIA/EIA-553	Current Analog Air Interface Standard	Published 09/89
IS-19-B	Mobile minimum performance standards	Published 05/88
IS-20-A	Base Station minimum performance standards	Published 05/88
IS-3	Original Analog Air Interface Standard	now TIA/EIA-553
TSB-39	Message Type Assignment for Extended Protocol	Published 03/93
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	Analog air interface (including "NAMPS" and Authentication)	Published 09/94
IS-94	In-building analog air interface ("FreedomLink")	Published

TDMA Digital Air Interface Standards

Standard	Description	Comment
IS-54-B (TIA/EIA 627)	Original TDMA Dual-Mode Air Interface Standard	ANSI Ballot
IS-55 (TIA/EIA 628)	TDMA mobile performance standards	ANSI Ballot
IS-56 (TIA/EIA 629)	TDMA base station performance standards	ANSI Ballot
IS-85 (TIA/EIA 635)	TDMA full-rate voice coder (3:1)	ANSI Ballot
TSB-46	Verification of Authentication for IS-54-B Mobiles	Published 03/93
TSB-47	IS-54 Implementation Issues	Published
TSB-50	User Interface for Authentication Key Entry	Published 03/93
TSB-61	Authentication Key Mobile Entry Procedures	Published
IS-54-C	*See IS-136*	*Cancelled*
IS-7X	*See IS-136*	*Cancelled*
IS-136	IS-54-B plus Digital Control Channel (DCC)	Published 01/95
IS-130	TDMA data radio link protocol	Ballot
IS-135	TDMA asynchronous fax and data air interface	Ballot
IS-137	DCC mobile performance standards	In Press
IS-138	DCC base station performance standards	In Press

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CDMA Digital Air Interface Standards

Standard	Description	Comment
IS-95	CDMA Dual-Mode Air Interface Standard	Published 07/93
IS-96	CDMA Option 1: Voice Coder	Published 04/94
IS-97	Base Station minimum performance standards	Published 12/94
IS-98	Mobile minimum performance standards	Published 12/94
IS-99	Data Services	Ballot
IS-125	Option 1: Performance Standards	In Press
IS-126	Option 2: Loopback	Published 12/94
IS-127	Option 3: Enhanced Voice Coder	Development
IS-637	Short Message Service	In V&V
IS-XXX	Packet data services	Development
TSB-58	Option Number Assignment	Development
TSB-66	Technical Corrections to IS-95	Development
IS-95-A	IS-95 Revised	Ballot
IS-96-A	CDMA Voice Coder	In Press

Authentication Appendices

Description	Comment
Message Encryption and Voice Privacy	Requirements for the application of authentication, voice privacy and signaling message encryption algorithms
Common Cryptographic Algorithms	Algorithm definition

A US Department of State export license may be required to gain access to these authentication documents. Contact the Telecommunications Industry Association at 1-703-907-7700 for details of their Technology Transfer Control Plan. These authentication algorithms are necessary to fully implement IS-54, IS-91, IS-95, IS-136 and other future cellular air interface standards.

Notes:
1. IS- denotes a TIA Interim Standard.
2. TSB- Telecommunications Systems Bulletin. This type of document has less force than a standard and is often used to publish useful guidelines or information that may require field implementation before full standardization.
3. EIA/TIA- indicates a full standard.
4. **Bold Type** indicates basic air interface standards. Documents listed in plain type provide options, clarification, requirements etc.