

Cellular Networking Perspectives

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

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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.

If in Doubt ... Reorganize

The TR-45.2 sub-committee has reorganized its working groups to better reflect the 3 stage development process that it adopted some time ago. The new structure is shown in detail in a report on Page 5.

The three stages of standards development are:

- I. User Perspective.
Definition of how individual features should operate from an end-user point of view. This stage is published in IS-53.
- II. Network Perspective.
A logical definition of network transactions required to support all features and capabilities. This stage is published in IS-41 sections 1, 2, 3 and 4.
- III. Implementation Perspective.
A precise definition of the messages, parameters, timers and procedures necessary for all vendors to implement all features in a consistent, compatible and unambiguous fashion. This stage is published in IS-41 sections 5 and 6.

These 3 stages of development are now the responsibility of Working Groups I, II and III, respectively, replacing the groups previously numbered I, II, III and V. No change has been made to the identification or mandate of Working Groups IV, VI and VII.◊

Next issue due: April 4, 1995

New Cellular Features: The Lucky 9 for '95

Of the 45 features being examined by the TR-45.2 sub-committee for inclusion in IS-53 Revision B and IS-41 Revision D, 9 were recently blessed by the CTIA. The chief technical officers of cellular carriers decided by a voting process that only the following features should be standardized in 1995:

1. Calling Name Identification.
Display the name of the calling party when a call is received by a cellular phone, instead of the calling phone number.
2. Emergency Services.
Enhanced 9-1-1 service to provide features such as location determination, callback and priority access.
See the October, 1994 issue for more details.
3. Law Enforcement Intercept.
Monitoring of calls to or from certain mobiles to meet US legal requirements.
See the August, 1994 issue for more details.
4. Identity Confidentiality.
Protection of the identity of cellular phones by not transmitting mobile identifying information in the clear across the cellular control channel.
5. Incoming Call Screening.
Screening of incoming calls to redirect unwanted calls to an announcement or to voice mail.

- 6. Voice Controlled Services.
The ability to control services by voice command.
- 7. Group 3 Facsimile Transmission.
More reliable transmission of faxes to and from cellular phones connected to a PC or fax machine.
- 8. Short Message Delivery - Multi-Point Bearer Service.
The ability to send one short message to a group of related SMS-capable terminals.

As the CTIA represents most cellular carriers the TR-45.2 sub-committee will take their direction seriously and likely include these features in the development of IS-53 Revision B and IS-41 Revision D. It is unlikely that the remaining services will be standardized at this time, due to the many months of delay completing IS-53 Rev. A and IS-41 Rev. C which incorporated about 20 new features. Some addi-

SMS: Cellular Short Message Service, Part II

In our first issue discussing cellular Short Message Service (SMS) we described the basic network architecture and services. We will complete this two part series by describing some of the details of its implementation.

Handoff

After a mobile has been handed off to a neighbouring MSC, short messages will still be delivered to the MSC that originally handled the call (the "Anchor" MSC). Special IS-41 transactions are required to forward incoming short messages to the terminal or, in the reverse direction, to pass mobile originated messages back to the Anchor.

Mobile SME Status Monitoring

If a mobile SME becomes unavailable (e.g. turned off), the Message Center

(MC) will stop attempting to transmit short messages to avoid consuming network bandwidth unnecessarily. The mobile status can be determined through a

most of the time. This is a similar technique to that used by pagers, although cellular battery life will likely only be measured in days and not weeks.

<u>Alternatives to Short Message Service</u>	
Short Message Service will compete with several other methods for delivering similar information, each with unique advantages and disadvantages:	
Paging	Pagers have the advantages of smaller size, longer battery life and cheaper service. However, they do not have message acknowledgement (yet) nor the functionality of a built-in phone.
Voice Paging	ReadyCom of North Carolina has a unique voice paging product based on modifications only to a cellular phone and a voice mail system. It provides a form of sleep mode to extend battery life to about a week and uses compression to deliver voice messages more cheaply to the phone's message memory.
Circuit Data	Increasingly, cellular phones are being used to dial in to online services to access e-mail. While messages can be much longer than SMS provides, automatic new message notification is not generally provided.
CDPD	CDPD provides similar e-mail capabilities to circuit data, although being based on packet data protocols is more suitable if messages are small and frequent. New message notification makes more sense with CDPD.
SMS will be squeezed in price and functionality between paging and data services. It will appeal to the existing base of cellular phone users rather than moving people away from alternative services.	

response to a failed message delivery, or in an autonomous message from the system currently serving the mobile.

Battery Saving Modes

One of the most serious problems of cellular phones, compared with pagers, is battery life. Newer digital air interface standards, both CDMA (IS-95 Rev. A) and TDMA (IS-136) have attempted to combat this by allowing the phone to receive service while being turned off

Slotted Mode in CDMA (and a similar mode in IS-136 TDMA) allows a cellular phone to be on only a fraction of the time, with its awake periods closely synchronized with the base station. The base station can transmit, at the predetermined wakeup time, an indication of whether the mobile should go back to sleep right away, or stay awake to receive some messages that are waiting for it.

Short Messages are one of the most likely reasons for a sleeping phone to awaken. If the phone is asleep for the maximum 2 minute interval in Slotted Mode, delaying incoming calls is out of the question. However, the non-realtime nature of short messages makes them a good candidate for this treatment.

Battery saving modes do have a network impact. The serving system has to remember that a sleeping mobile has outstanding short messages in order to keep it awake at the end of the next period, and the Message Centre should not retransmit messages that failed due to a dozing mobile. Support for Sleep Mode was added late in 1994 to the baseline Short Message specification in IS-41 Rev. C.

CDMA, to add to the confusion, contains an alternative to

Slotted Mode, called Sleep Mode, which involves the phone powering itself off for a longer period of time, but needing to completely resynchronize when it awakens. Both modes can be treated alike from an SMS perspective.

Compatibility

At least at first, mobiles with SMS capability will not always be roaming in an area with SMS capability. When this is determined, the Message Center should

turn off message delivery. When the mobile reenters an area that does support SMS, message delivery can be turned back on.

A second compatibility issue concerns both the significant and subtle differences in SMS support in different air interfaces. This will either lead to complex interworking and translation or to support for only the lowest common denominator.

Air Interface Support

Short Message Service is not supported by the majority of cellular phones that are currently in service, those that were designed to the EIA/TIA-553 analog specification. Newer phones incorporating modern air interface standards support SMS, although the level of sophistication varies widely:

- IS-88 This standard defining NAMPS (Narrowband Analog) supports SMS delivery as an option using a restricted alphabet (e.g. upper case letters only) as an optional capability. Many new analog phones and many cellular systems support this standard.
- IS-91 This new analog standard incorporates NAMPS (IS-88) and thus brings support for SMS as an option to wideband analog cellular phones. Few phones have been built to this standard as it was only published in September 1994.
- IS-95 Revision A of the CDMA digital cellular standard will support SMS originations and terminations using the full ASCII alphabet. This standard is expected to be published soon.
- IS-136 This enhanced standard for TDMA digital cellular will provide SMS capabilities similar to IS-95-A on the new digital control channel. This standard was published in January, 1995.

Roaming Support

Short Message Service can only be supported seamlessly for roamers when intersystem operations are standardized in IS-41. Revision C of this standard, due

for ballot starting March, 1995, will support SMS. IS-53 Revision A, approved for publication but not yet sent to press, contains a description of the cellular Short Message feature.

Mobility

Mobility is managed in IS-41 SMS by two mechanisms: location tracking and temporary routing addresses. Location tracking builds off the normal IS-41 registration procedure and was described in the first part of this series. The temporary routing address is analogous to the TLDN used for routing voice calls. This address is local to the system currently serving a roamer but, unlike a TLDN, the SMS temporary routing address can be assigned to the local system, not to individual mobiles, and therefore can be used for multiple transactions.

Protocol Structure

Short Message Services messages are transmitted around the cellular network using a multi-layered protocol. Several new messages have been

Layering

Short Message Service messages are supported by two new protocol layers. The Bearer layer carries messages around the network and exists as an extension to IS-41. Teleservice information rides in a layer above the Bearer service supporting a particular application. Teleservices are carried transparently to IS-41.

The only bearer service defined in IS-53 Rev. A and IS-41 Rev. C is the Point-to-Point bearer service. In future standards more may be defined:

Point-to-Point This existing bearer service allows for the transmission of a short message from one point in the network to another. This service is defined using a group of new IS-41 messages.

Multi-Point This service would allow one short message to be transmitted to multiple SME's. This is one of the CTIA priority features for IS-53-B and IS-41-D.

See article on Page 1.

Broadcast This bearer service would allow a short message to be broadcast to all SMS-capable terminals in a group of cellsites.

Two basic teleservices are defined in IS-53 Rev. A. They are carried transparently by IS-41 Rev. C. Other teleservices can be supported if both the MC and mobile implement them:

Paging The transmission of messages up to 63 characters long consisting of digits, upper-case letters and some punctuation. Messages can be acknowledged.

Messaging The transmission of messages up to 200 characters long using the full alphabet. Messages can be acknowledged with a numeric code. This can only be supported by IS-95-A and IS-136 terminals at present.

IS-41 Transactions

The IS-41 Revision C standard defines several new transactions that support the Point-to-Point bearer service and that carry teleservice information transparently:

- **SMSDeliveryPointToPoint**
This transaction carries a short message between a Message Centre (MC) and a Short Message Entity (SME) or between two SME's.
- **SMSNotification**
Notifies an MC that message delivery is either on or off for a particular SME and provides a temporary routing address.
- **SMSRequest**
Requests a temporary SMS routing address for a roamer.
- **SMSDeliveryForward**
Forwards a short message towards a mobile SME along the inter-system handoff chain from the Anchor MSC to the Serving MSC.
- **SMSDeliveryBackward**

Transmits a short message to the Anchor MSC from a mobile SME after inter-system handoff.

Two existing IS-41 transactions have been modified to better support SMS:

- **RegistrationNotification**

This message can convey a temporary SMS routing address when a roaming SMS-capable terminal registers in a new, SMS-capable, system.

- **RegistrationCancellation**

Indicates whether a message was waiting for the mobile SME to come available at the time the mobile moved to the new system.

Summary

Short Message Service is an important new capability in the cellular network. It is one of several new services, varying widely in functionality, that are trying to meet customer demands for wireless data transmission. Whether SMS has hit the right spot on the price-performance curve will have to be left for the marketplace to decide.◊

Guest's Cell: P.J. Louis on Seamlessness

In this article, P.J. Louis (Chairman of TIA TR-45.2 Working Group VII on PSTN/ISDN Interfaces) ponders the definition of Seamlessness, posing the question "How can the goals of Seamlessness and Product Differentiation both be fulfilled?"

Users of wireless phones want seamless service, where services can be invoked and operated in the same way in any network. Seamlessness is a service concept that the wireless telecommunications industry is striving to provide. Users do not want to spend their time or energy learning different procedures to invoke the same feature whenever they move from one system to another, especially considering that users do not usually even know what system they are being served by at any moment.

Regardless of how carriers implement a service, the user wants to push the same buttons every time. Realistically, this is difficult to accomplish as long as product differentiation is also an important goal.

Product (service implementation) differentiation should only be a problem with users who roam from one carrier's system to another carrier's system. The more often a user roams, the greater the impact on the subscriber that differences in the way one carrier provides a service from another will have.

If the "crystal ball" prophets of the telecommunications industry are accurate, mobility will grow rapidly, leading to the day when achieving and maintaining seamlessness will pose a greater challenge.

How can seamlessness and product differentiation both be attained? That is the question that all wireless carriers and manufacturers should be trying to answer.◊

TR-45.2 Standards Update: IS-52 Rev. A and IS-53 Rev. A Available Real Soon Now

TIA subcommittee TR-45.2 has forwarded IS-52 Rev. A to the TIA for publication. IS-53 Revision A is following along close behind. The status of each major outstanding TR-45.2 project is listed below, in approximate order of completion:

IS-41 Rev. B Technical Notes (TSB-41, SP-2985) • Published November, 1994.

Cellular Dialing Plan (IS-52 Rev. A, PN-3166) • In Press. The final version of this dialing plan standard was approved by TR-45.2 on February 24, 1995. This followed several rounds of post-ballot editing to ensure that all changes agreed to during ballot review were correctly incorporated.

Subscriber Features (IS-53 Rev. A, PN-2977) • The pre-publication version of IS-53 Revision A is undergoing editorial review to ensure that

all approved ballot comments have been incorporated correctly. It will likely be approved for forwarding to the TIA for printing during the March 27-31, 1995 TR-45.2 meeting.

IS-41 Revision C (PN-2991) • This revision of IS-41 is scheduled for 60 day ballot starting March, 1995. The document is now in V&V (Verification & Validation), although not all text is available, especially for Short Message Service. Revision C is approximately 5 times as large and complex as Revision B.

International Applications (TSB-29 Rev. B, PN-3173)

TR-45.2 WG VI is studying the implementation of E.212 mobile identification, international SS7 global title translation requirements, double dipping and other issues, for incorporation in TSB-29 Revision B, scheduled for ballot in January, 1996.

Online Call Record Transfer (IS-124 Rev. A, PN-3293) • TR-45.2 is considering revisions to the "DMH" standard for the online transfer of call records for billing, fraud and other purposes. Cibernet is currently sponsoring meetings to develop subsets of the DMH for fraud and billing.

Subscriber Features (IS-53 Rev. B, PN-3362) • The CTIA has proposed a list of 9 features that cellular carriers most want in IS-53 Rev. B and IS-41 Rev. D. This proposal will likely be accepted by TR-45.2. See article on Page 1.

IS-41 Rev. D • This version will support all IS-53 Rev. B features, where inter-system operations are necessary, and will also support advanced features of the TDMA and CDMA digital control channels. A workplan is under development.◊

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TIA TR-45.2 Cellular Intersystem Operations Working Group Report

*Cellular
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Perspectives*

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

WG	TG	Mandate	Chair	PN	Title	Editor
Plenary		Cellular System Operations	John Marinho Cheryl Blum (vice-chair)			
I		Stage I Development (User Perspective) (previously WG V)	Terry Watts	2977	Cellular Features Description (Rev. A)	Terry Watts
				3362	Cellular Features Description (Rev. B)	Terry Watts
II		Stage II Development (Network Perspective) (previously WG II and III)	Cheryl Blum	2991	IS-41 Rev. C	Terry Watts
				–	IS-41 Rev. D	not assigned
III	1	Stage III Development (Encoding & Procedures) (previously WG I) Fax & Data	Charles Ishman Thomas Ginter	2991	Cellular Radio Telecommunications Inter-system Operations (IS-41-C)	Terry Watts
				–	IS-41 Rev. D Fax & Data over Cellular	not assigned
IV		Message Accounting	John Willse	3293	Cellular Inter-System Non-Signaling Data Communications (IS-124-A)	Kirk Carlson
V		inactive				
VI		International Applications	David Crowe	3173	International Implementation of Cellular Radiotelephone Systems Compliant with ANSI/EIA/TIA-553 (TSB-29-B)	Steve Jones
VII		Interfaces to Other Telecommunications Networks	P.J. Louis	3295	Ai and Di Interfaces Standard (PSTN/MSC) (IS-93 Rev. A)	not assigned
				3166	Uniform Dialing Procedures for use in Cellular Radiotelephone Systems (IS-52 Rev. A)	Steve Jones

Notes: WG - Working Group number (assigned by TIA TR-45.2 sub-committee)
 TG - Task Group number
 PN - Project Number (assigned by the TIA to standards under development)