

Cellular Networking Perspectives

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A Sweet Reason to Drop Our Name

It is an unfortunate fact of modern life that some companies are not benefiting from a subscription to *Cellular Networking Perspectives*. We will reward you handsomely for providing us with the name and phone number (or address) of a person who could benefit from a subscription. The prize if your tip results in a new subscription? A box of a eighteen hand-made Belgian chocolates. And if you are on a diet, just think what a nice present they would make.◊

FCC Allocates PCS Frequencies

The FCC announced on September 23rd the allocation of 160 MHz of spectrum in the 1.8-2.2 GHz band for PCS services. This could add up to 7 new competitors to the 2 existing cellular carriers in each market. The major features of this announcement are:

- Allocation of 120 MHz of spectrum in 7 blocks for licensed PCS services. Two blocks in each license area are 30 MHz, one is 20 MHz and four are 10 MHz. By comparison, cellular licenses are for 20 MHz.
- Allocation of 40 MHz of spectrum for unlicensed PCS applications in the 1890-1930 MHz band, evenly divided between voice and data applications.
- License areas based on the 51 Rand McNally Major Trading Areas (MTAs) for the 30 MHz blocks and the 492 Basic Trading Areas (BTAs) for the 20 MHz and 10 MHz blocks.
- Licensees can aggregate up to 40 MHz in one license area.

- Cellular licensees (defined as owning 20% or more of a cellular system) are prohibited from applying for more than a single 10 MHz license where they currently serve more than 10% of a PCS license area.
- Licensees must offer service to one-third of the population in each market area within 5 years of being licensed, two-thirds within 7 years and nine-tenths within 10 years.
- The FCC has not mandated standards, but encourages the "industry to continue its efforts to develop standards that will promote interoperability, roaming and enhanced emergency 911 capability".

The standards impact of PCS licensing could be significant, although this FCC decision is just one of several forces pushing PCS at present. Network based standards may be much harder to develop in PCS than in cellular. While cellular started with one air interface standard, considerably simplifying the development of the IS-41 standard for automatic roaming, it is unlikely that PCS will start with a single air interface standard. Nor is there a guarantee that all vendors and service providers will be committed to the development of common automatic roaming procedures. The risk is that in the drive towards product differentiation and competition, PCS service will be perceived by potential customers as much more complex and difficult to use than cellular; precisely the opposite image than is needed to develop the 'personal' wireless market.

Comments Welcome

We welcome comments on the contents and format of this newsletter, suggestions for future topics, corrections or additional information.

Additional factors in the forthcoming competition between established cellular services and upcoming PCS services will be the balance between the current problems of cellular and the new problems of PCS. Cellular is saddled with 12 million analog terminals that make poor use of spectrum and that are prone to fraud. PCS, by comparison, has to pay to displace existing point-to-point microwave users and has to deal with more spectrum than a single radio design may be able to handle with present day technology. The comparative speed with which each industry can deal with their unique problems will determine their competitiveness. One FCC commissioner, Andrew C. Barrett, in a dissenting opinion describes his belief that PCS spectrum was broken into too many small pieces to allow effective competition with cellular. ♦

IS-53 Revision A , Part I - Cellular Feature Overload

Cellular features are defined in IS-53. Revision 0, published in 1991 defined basic features: 3 Party calling and Call Forwarding. The upcoming Revision A adds many more features, and more exotic features. The new features are based on a list of high priority feature names from the CTIA (Cellular Telecommunications Industry Association). Although the IS-53 Rev. A we describe has not been approved by the TIA, it is not expected to change much before publication.

In this issue we provide a summary of some of the features that will likely be found in IS-53 Rev. A. Part II, to be published in the November issue of *Cellular Networking Perspectives* will complete the list. We will then conclude our series with a discussion of major issues related to features, and IS-53 in particular:

- Impact on the cellular network.
- Interactions between features.
- Cost, Complexity and Completeness tradeoffs.
- User interface issues.
- Landline compatibility.

Call Forwarding

Call forwarding features allow subscribers to specify the handling of incoming calls when they cannot or do not wish to receive them. IS-53 Rev. 0 defined the basic types of Call Forwarding; Unconditional, Busy and No Answer. IS-53 Rev. A adds Call Forwarding Default (for redirection to voice mail) and Selective Call Acceptance, which allows forwarding of selected callers.

Call Forwarding Unconditional

Call Forwarding Unconditional, included in IS-53 Rev. 0, redirects all incoming calls to a forward-to number chosen by the subscriber.

Call Forwarding Busy

Call Forwarding Busy, also included in IS-53 Rev. 0, redirects all incoming calls to a busy mobile to a forward-to number chosen by the subscriber.

Call Forwarding No Answer

Call Forwarding No Answer, also included in IS-53 Rev. 0, redirects all incoming calls to a mobile that is powered off, out of its service area or that is not answered, to a forward-to number chosen by the subscriber.

Call Forwarding Default (Voice Mail)

Call Forwarding Default redirects incoming calls to voice mail when a mobile is busy, does not answer or is turned off. This feature is usually permanently activated by the service provider and programmed with the subscriber's personal voice mailbox number. It can be temporarily overridden by programming in any other type of call forwarding.

Selective Call Acceptance

This feature, which is described in more detail later, can be used to forward unwanted calls to another number, most likely voice mail.

3 Party Calling Features

Several features allow more than two phones to be connected together in some useful way. Call Waiting allows two calls to be juggled from one phone, while Three Way Calling, Call Transfer and Conference Calling deal with calls where three or more parties may be in conversation together.

Call Waiting

Call Waiting allows a busy mobile to handle an additional incoming call. This feature, defined in IS-53 Rev. 0, works very much the same as in landline systems, using the SEND button to represent the landline flash hook. A call receiving the call waiting beep can answer the additional call by pressing SEND, and can toggle between the two calls as many times as desired.

Three Way Calling

Three Way Calling allows a three way conversation to be set up from a mobile. The method is similar to that used in landline systems, but cannot be simulated as closely as for Call Waiting. A subscriber to this feature may press SEND to put the original party on hold, dial another phone number and press SEND again to connect in private conversation to any other party. Pressing SEND once more connects all three parties together.

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Call Transfer

This feature can be viewed as an add-on to Three Way Calling. It allows the controller of a three way call to drop out of the call, without disconnecting the other two parties (but implicitly agreeing to continue paying!). The feature is activated simply by disconnecting from the call during three way call setup, even before three way conversation is reached.

Conference Calling

This feature allows a conference call with more than three parties to be set up. Because control is more complex, it is not sufficient to use the SEND key as the only control signal. Functions such as adding or deleting a party are handled by dialing a feature code (*XX + digits) during the call. Do not attempt this without the manual open!

Incoming Call Control

Incoming Call Control features are designed to prevent the reception of incoming calls. Their prime purpose is not to redirect incoming calls, although they may do that, but to prevent receiving calls to avoid toll charges (Call Delivery), to avoid certain people (Selective Call Acceptance) or to avoid any incoming calls (Do Not Disturb).

Call Delivery

This feature allows a subscriber to stop receiving calls while roaming. This is desirable because roamers generally pay the toll charges for the distance between their home system and current location. This feature does not affect terminations through the roamer port, nor terminations in a subscriber's home serving area, neither of which generate toll charges for the mobile receiving a call. The need for this feature may disappear once Calling-Party-Pays services are widely available.

Do Not Disturb

This feature is similar to the Call Delivery feature as it controls terminations, but its purpose is quite different. It turns off all incoming calls, including those received in the home serving area and through the roamer port. It is equivalent to turning your phone off, although it has the advantage of continuing to drain the phone's battery.

Selective Call Acceptance

Selective Call Acceptance, the chameleon of features, can not only be viewed as a type of call forwarding, but also as a means of controlling incoming calls. While roaming, it is a more flexible version of the Call Delivery feature, allowing a subscriber to pay for calls from their boss and spouse, but not from their mother-in-law, for example.

The flexibility of this feature comes at a price. A list of numbers to accept calls from must be maintained, and the feature will reject calls from an unexpected phone number.

Continued Next Issue...

TR-45.2 Standards Update - DMH Released. IS-41 Doomed?

The first document to emerge from TIA subcommittee TR-45.2 with full approval turned out to be the biggest and most complex of all those under development; the DMH standard for online transfer of call detail records. The Ai-Di interface standard (recently assigned the designation IS-93) and the CDMA intersystem operations TSB have been approved for ballot, while the IS-41 Rev. A Compatibility TSB and the Border Cell TSB are both heading for rebalot.

IS-41 may be heading for oblivion. When it was first published in 1987, it was given 5 years to become a fully fledged ANSI standard, be reaffirmed as an interim standard ... or cease to exist. Towards the end of its official life in 1992, it was decided to pursue the completion of IS-41 Revision C and publish it as an ANSI standard. Now, with the completion of IS-41 Revision C being at best mid-1994, the committee is stuck. If another extension cannot be obtained they will be forced to rebalot IS-41 Revision B, with all its known flaws, or allow IS-41 to die, and revive IS-41 Rev. C as a new interim standard. This could prove to be embarrassing, and cause considerable confusion in the industry.

Intersystem Non-Signaling Data Communications (PN-2754) • This document, known internally as *DMH*, describes record layouts and protocols

for online transmission of cellular call detail records for billing, fraud detection and other purposes. This document has been **approved for publication as an interim standard**.

PSTN Interface (IS-93, PN-3098) • A definition of both the analog (i.e. MF signaling) and digital (SS7 signaling) interfaces required to connect MSCs to the PSTN has been written. It was **sent out for ballot** by the TIA on September 21st as **IS-93**.

CDMA TSB (PN-3199) • A TSB on CDMA inter-systems operations in IS-41 Rev. B systems has been completed by a Working Group I task group. The document was **approved for ballot** at the September TR-45.2 meeting.

IS-41 Rev. A Compatibility (TSB-55, PN-3063) • Procedures to allow IS-41 Rev. A implementations to be forward-compatible with Rev. B. Due to technically substantive changes made based on ballot comments, this TSB will be sent out for **reballot**.

Border Cell TSB (PN-2910) • The draft document to resolve several problems that occur on the border of cellular systems has been balloted. Due to the number of technical changes incorporated due to ballot comments an updated version has been circulated at TR-45.2. If the review reveals no major problems it will be **ready for ballot** at the October TR-45.2 meeting.

IS-41 Rev. B Test Plan (TSB-42, PN-2978) • An application level test plan for IS-41 Rev. B has been developed by WG II Task Group 2. This document has been completed and circulated at TR-45.2. It may be approved for ballot at the October TR-45.2 meeting.

IS-41 Rev. B Technical Notes (TSB-41, PN-2985) • Will resolve several ambiguities in IS-41 that have resulted in incompatibilities between implementations of IS-41 Rev. A by different vendors. Although the document is basically complete, due to a few unresolved issues, the date for ballot cannot be predicted.

Subscriber Features (IS-53 Rev. A, PN-2977) • A completely revised and rewritten version of the baseline document was accepted at the August TR-45.2 meeting. Publication is **scheduled for December, 1993**. This date may be delayed somewhat because a review of the document has been requested by other TR45 subcommittees.

IS-41 Revision C (PN-2991) • An initial draft of this revision of the cellular intersystem operations standard was available to committee members at the July meeting of TR-45.2. This document is still in a very preliminary state, not yet including, for example, text from TSB-51 on authentication. Publication is officially **scheduled for December, 1993** but more recent estimates place publication optimistically at **mid-1994**.

Cellular Dialing Plan (IS-52, PN-3166) • Plans are being made to revise the cellular dialing plan standard, IS-52 Rev. 0. An editing group has been initiated to attempt to rework this document and push it towards publication.

International Applications (TSB-29 Rev. B, PN-3173) • There are several recognized problems with the use of AMPS cellular outside North America. WG VI of TR45.2 is studying solutions to these problems (**see following article**). Publication is scheduled for December, 1993, but it is recognized to have a lower priority than other documents and its deadline is being allowed to slip.◊

Erratum: McCaw position on A-Interface Standardization

The August issue of *Cellular Networking Perspectives* erroneously stated that McCaw Cellular Communications was opposed to standardization of the cellular A Interface (Base Station to MSC). In fact, McCaw was only opposed to the allocation of resources within the already overloaded TR-45.2 sub-committee, and did agree to standardization of the A-Interface within the lightly loaded TR-45.4 sub-committee.◊

Taking MINs to the Max - Problems with International Roaming

North American cellular phones are always identified by a 10 digit Mobile Identification Number (MIN). But this, one of the few constants through the AMPS, NAMPS, TDMA and CDMA air interface standards, may be about to change. It has been recognized for several years that unique identification of mobiles from outside the 10 digit North American Numbering Plan (NANP) is difficult. Proposed changes to the NANP and increased international roaming traffic have the potential to create headaches in the near future.

The problem is that every 10 digit MIN (except those starting with 0 or 1) is a potentially valid North American number. Cellular systems using AMPS outside the NANP area (e.g. in Central and South America) usually place a country code at the beginning of the MIN. This becomes a problem when mobiles attempt to roam in a foreign country that, with no guide to the format of the MIN, misinterprets the number and denies each call attempt. For example, a cellular system in El Salvador may start MINs with their landline country code of 503, the area code of Oregon, or they might choose the mobile country code of 706, which is the area code of Rome, Georgia. Either way, problems!

At an Ad-Hoc TIA meeting on this subject in May, 1993 it was decided to investigate the long term solution of standardizing on a 15 digit mobile identification number, using standard CCITT Mobile Country Codes (defined in Recommendation E.212). For compatibility and efficiency, mobiles would only need to transmit 10 digits when in their home country, but would transmit an extra 5 digits elsewhere, including the 3 digit mobile country code. A letter has been sent from the TIA TR-45.2 subcommittee to all the 800 MHz air interface subcommittees (TR-45.1, TR-45.3, TR-45.4 and TR-45.5) asking them to investigate the feasibility of this change.◊

What Happened to September?

The publication schedule of *Cellular Networking Perspectives* has followed the schedule of TIA TR-45.2 meetings in the past. This has led to publication of each issue at the end of each month. In order to move to a more traditional publication schedule, this issue is dated October, and all subscriptions have been extended by one month.◊

Back Issues Available

Back issues from July, 1992 to present are available. Articles in recent issues are:

March, 1993

Wireless '93 in review.

April, 1993

TR-45.2 News. IS-41 Explained. TR-45.2 International Working Group VI.

May, 1993

IS-41 Rev. A Status Report. IS-41 Rev. B Status. NovAtel. DMH. IS-41 Enables Innovation. TR45.2 Project Status.

June, 1993

Wireless Terminal Location Management, Part I. Brace for the Standards Flood. TR-45.2 Working Group Report.

July, 1993

ITN Named CTIA Backbone IS-41 Network Provider. New TIA Standardization Efforts Loom. Wireless Terminal Location Management, Part II. TR-45.2 Grows More Tentacles. TR-45.2 Continues to Pump Standards Out. IS-41 Rev. B Trial Update. IS-41 Rev. A Implementation Status.

August, 1993

Bellcore Relinquishes Control of the NANP. Smart Cards, Dumb Phones? A+ Interface Looks for a Home. Wireless Terminal Location Management Part III - Lessons for PCS. TR45.2 Standards Update. Goldilocks and the Three IS-41 Addressing Types. Status of IS-41 Rev. B Implementation.

The price of a back issue is:

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TIA TR-45.2 Project Status Report

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Obsolete Interim Standards and TSBs

IS/TSB Title	Published
IS-41-0 Cellular Radiotelecommunications Inter-System Operations	02/88
IS-41-A Cellular Radiotelecommunications Inter-System Operations	01/91
TSB-27 IS-41 Application Notes (never published, date is when released to WG I)	07/89

Published Interim Standards

IS	Title	WG	Published
IS-41-B	Cellular Radiotelecommunications Inter-System Operations	I	12/91
IS-52	Cellular Subscriber Dialing Plan and Service Codes	V	11/89
IS-53-0	Cellular Features Description	V	09/91
IS-?	Cellular Inter-System Non-Signaling Data Communications	IV	09/93

Published Telecommunications Systems Bulletins (TSBs)

TSB	Title	WG	Published
TSB-29-A	International Implementation of Cellular Systems Compliant with TIA-553	VI	09/92
TSB-51	Inter-System Authentication, Signaling Message Encryption and Voice Privacy	I	02/93
TSB-56	Application Level Testing for IS-41 Rev. A, IS-53 Rev. 0	II	03/93

Projects in Ballot Process

PN	Title	Editor	WG	IS/TSB
2910	Mobile Border System Problems	David Crowe	I	(unassigned)
3063	IS-41 Rev. A/B Forward Compatibility	Charles Ishman	I	TSB-55
3098	Ai and Di Interfaces Standard (PSTN/MS)	Mike Buhrmann	VII	IS-93
3199	Wideband Spread Spectrum Intersystem Operations	James Yu	I	(unassigned)

Active TR45.2 Projects

PN	Title	Editor	WG	IS/TSB
2977	Cellular Features Description (Rev. A)	Terry Watts	V	IS-53-A
2978	Application Level Test Plan (IS-41-B, IS-53-A)	David Crowe	II	TSB-42
2985	Technical Notes for IS-41 Revision B	Arzu Çalis	I	TSB-41
2991	Cellular Radio Telecommunications Intersystem Operations	Terry Watts	I	IS-41-C
3166	Uniform Dialing Procedures for use in Cellular Radiotelephone Systems	Steve Jones	VII	IS-52-A
3173	International Implementation of Cellular Radiotelephone Systems Compliant with ANSI/EIA/TIA-553	Steve Jones	VI	TSB-29-B