



Cellular Networking Perspectives

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

Vol. 3, No. 7 July, 1994

In This Issue ...

FCC Revises PCS Decision

p. 1

The FCC has made several changes to its original broadband PCS allocation rules.

FCC may Impose Equal Access on all Cellular Carriers

p. 2

The FCC is considering whether all cellular subscribers should be able to use their preferred long distance carrier for cellular calls.

Intersystem Call Delivery, Part V: Compatibility

p. 2

How new call delivery features are integrated into the cellular network.

TR45.2 Standards Update

p. 4

IS-41 Rev. B Test Plan (TSB-56 Rev. A) is now available. The TSB-41 ballot period has been extended to July 8th.

FCC to Investigate Interconnection Obligations

p. 4

The FCC is investigating the interconnection obligations of LEC's to cellular carriers and of cellular carriers to other carriers (e.g. PCS).

TIA TR45.2 Project Status Report

p. 5

FCC Revises PCS Decision

The FCC, on June 9th, 1994, modified its rules for the allocation of broadband PCS spectrum. The modifications will make implementation of broadband PCS service cheaper and easier, but whether it is enough to save PCS from being the poor cousin of cellular remains to be seen.

The decision solidifies the implicit attitude of the FCC that PCS will be competition for cellular and not for wireline phone systems. Cellular companies are still restricted from bidding for more than 10 MHz of spectrum in areas where they already have even a small amount of cellular coverage, yet wireline companies are not restricted at all, even where they have a complete monopoly.

The changes between the old rules and the new are summarized in Table 1.

Some of the benefits from the changed rules are:

1. Competitive pressures are relieved slightly by providing one fewer license.
2. Expenditures on microwave relocation will be reduced through compression of the total band to areas where incumbent microwave users are less of a problem.
3. Capital and operating expenditures are trimmed through reduced coverage requirements (although the benefit occurs only after 7 years for MTA licensees) and through increased power levels (i.e. fewer, higher power cells).
4. Roaming is facilitated through compression of the bands, making multi-mode equipment more feasible, and through rationalizing the band sizes into either 30 MHz or 10 MHz.
5. Cellular carrier eligibility for a 30 MHz license is improved by allocating one 30 MHz license on a BTA basis. Cellular carriers may well be

Table 1	Old Rules	New Rules	Benefits
Spectrum Blocks	2x30MHz 1x20MHz 4x10MHz	3x30MHz none 3x10MHz	a. Less competition b. Easier roaming
Licensed Service Area	2 MTA (30 MHz) 5 BTA (20, 10 MHz)	2 MTA (30 MHz) 4 BTA (30, 10 MHz)	
Frequency Range	1850-2200 MHz	1850-1990 MHz	c. Easier roaming
30 MHz Coverage (% of population)	1/3 in 5 years 2/3 in 7 years 9/10 in 10 years	1/3 in 5 years none 2/3 in 10 years	d. Lower costs (long term)
10 MHz Coverage	1/3 in 5 years	1/4 in 5 years	
Power Levels	100 watts (e.i.r.p.)	1640 watts (e.i.r.p.)	e. Lower costs

eligible as non-cellular license applicants for several BTA's within an MTA that they are ineligible for a license in.

Two major unanswered questions are whether the revised PCS rules will be attractive enough to make for successful spectrum auctions and whether the lack of FCC-imposed standards will result in chaos for PCS subscribers.

For reference, the most important unchanged aspects of the PCS rules are listed below:

- License areas are based on the 51 Rand McNally Major Trading Areas (MTAs) for the 30 MHz blocks and the 492 Basic Trading Areas (BTAs) for the 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.
- The FCC has not mandated standards, but encourages the "industry to continue its efforts to develop standards that will promote inter-operability, roaming and enhanced emergency 911 capability". Currently both GSM and TIA standards are being considered by both potential PCS equipment vendors and service providers, as well as new technology that is not yet standardized.◊

FCC may Impose Equal Access on all Cellular Carriers

The FCC gave notice on June 9th that it will be investigating whether to impose "Equal Access" obligations on all cellular carriers and, eventually on all Commercial Mobile Radio Service (CMRS) Carriers, including ESMR and PCS.

Equal Access allows cellular subscribers to access their preferred long distance carrier simply by dialing "1+" and having the current cellular system retrieve their preferred inter-exchange carrier code (PIC) from their HLR. Alternatively, a subscriber can explicitly choose a carrier with 10XXX dialing (to be modified to 101XXXX dialing in 1995).

The imposition of equal access obligations does not imply the imposition of other restrictions on operations across long distance boundaries, such as the prohibition against transmitting roamer status information that complicates the provision of inter-system call delivery services by MFJ-restricted RBOC's. In fact, a ruling in favour of making equal access obligations universal may enhance the need for IS-41, as it is the best method to retrieve the PIC for roamers from its HLR.

One problem that will have to be faced by some cellular carriers is that a software upgrade to support equal access may either be prohibitively expensive or, worse yet, unavailable. These carriers may have to petition for at least temporary relief from equal access obligations until they can afford to upgrade or replace their switching equipment.◊

Intersystem Call Delivery, Part V: Compatibility

In the earlier parts of this series we discussed various ways that IS-41 intersystem call delivery has evolved to meet competitive and regulatory requirements. Features have become more complex and the demand for seamless roaming has grown. MFJ restrictions on the cellular subsidiaries of the Regional Bell Operating Companies (RBOC's) have created additional complexities and methods to optimize call delivery have been developed.

However, improvements and adaptations come at a price for IS-41 as for any protocol. The price, particularly for a wide area network with distributed intelligence, such as the IS-41 call delivery network, is the difficulty of upgrading while maintaining compatibility between all revisions of the protocol used to communicate between intelligent nodes. The problem of compatibility for intersystem call delivery is especially challenging, as can be seen from the following list of existing protocol versions:

1. GTE TSI and EDS PCD still provide semi-automatic pre-IS-41 call delivery through their proprietary FMR (Follow-Me Roaming) and RoamingAmerica systems.
2. IS-41 Revision A provides basic call delivery without compatibility guidelines.
3. TIA TSB-55 (in press) provides compatibility rules that, if implemented, can make IS-41 Rev. A systems compatible with IS-41 Rev. B.
4. IS-41 Revision B with enhanced call delivery and compatibility rules.
5. TIA TSB-41 (in ballot) that provides clarifications and enhancements to resolve compatibility problems discovered during the testing of IS-41 Rev. A and Rev.

Comments Welcome

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

Back Issues

All our back issues are available by fax or mail. Phone or fax us for a complete list of issues, contents and prices.

B (but not soon enough to be incorporated in IS-41 Rev. B!).

6. IS-41 Revision C with many new features affecting inter-system call delivery (e.g. extension phone services).

FMR and RoamingAmerica

These protocols, developed by GTE TSI and EDS PCD (then *Appex*), provide a semi-automatic form of inter-system call delivery. Roamers must dial a special code to register their presence in every system that they want to receive calls in. The FMR and RoamingAmerica systems then update the roamer's home system with a call forwarding number that can be used to redirect incoming calls to the correct system.

The major problems with these protocols are that they require manual activation, they require the user to know when an invisible system boundary is crossed and they interfere with the normal operation of call forwarding. However, these systems are still extensively used today, and interoperability with IS-41 is necessary to ease the transition to IS-41.

GTE and EDS both provide interoperability that is relatively transparent to other systems by providing IS-41 gateways. Systems can communicate with these gateways using IS-41 protocols, which are internally converted into proprietary protocols. This allows users of FMR and RoamingAmerica to continue to receive service while roaming in IS-41 systems.

IS-41 Rev. A and TSB-55

IS-41 Revision A was published with support for basic call delivery but without compatibility guidelines. Its most serious transgression was not specifying what action to take when receiving a message with an unknown parameter. One logical action to take, in the absence of instructions otherwise, is to discard the message. Some systems did this,

resulting in most IS-41 Rev. B messages being discarded, even though they could have been processed if the additional parameters were simply ignored.

TIA TSB-55, in press, adds this compatibility capability and should be implemented by all IS-41 Revision A systems to allow interconnection with IS-41 Rev. B and Rev. C. The CTIA has recognized the disruption and expense that will be caused by a TSB-55 upgrade, and has organized a vendor and carrier forum in Denver on July 19th, 1994 to discuss this issue.

IS-41 Rev. B and TSB-41

IS-41 Revision B is also not without compatibility problems, even though it does contain an extensive set of compatibility guidelines. The problems occurred because IS-41 Rev. B was published less than a year after IS-41 Rev. A, which was not enough time to allow the implementation of Rev. A in the field, which would have allowed the time to find and resolve many of these problems in IS-41 Rev. B.

The problems resolved in TSB-41 are not as important as the compatibility guidelines published in TSB-55 because they generally affect only one specific scenario. An example of one such problem is the handling, by a visited system, of an IS-41 message containing an ESN different than the mobile registered and was initially validated with. Is this an error or a way for the HLR to inform the visited system that the roamer's mobile has been replaced? TSB-41 rules that, in this case, the visited system should now treat the new ESN as the valid one, and deny service to the old one.

In a few cases, TR-45.2 decided that IS-41 Rev. B was inadequate, even when clarified, and changes were made to the specification. Those that are relevant to Call Delivery are listed below:

1. A new CSSDeregistration mes-

sage was added to allow a visited system to inform an HLR that a mobile is known not to be registered any more (e.g. digital mobiles deregister when they are turned off). This will probably cause the HLR to stop delivering calls to the visited system for that mobile.

2. A new BulkDeregistration message allows a visited system to inform an HLR that it has deleted all roamer records associated with that HLR.
3. The visited system can distinguish between the *Inactive* and *No Page Response* conditions when call delivery is attempted. The *Inactive* code indicates that a mobile has been inactive for long enough that call delivery should not be attempted by the HLR until the mobile registers again, while the *No Page Response* condition indicates that the unavailability may be only temporary and call delivery should be attempted again. This change will make redirection to voice mail more effective and faster, especially on MFJ-restricted systems.

IS-41 Rev. C

IS-41 Revision C will hopefully be the first revision of IS-41 to avoid serious compatibility problems. However, to ensure that compatibility problems do not occur extensive review of the protocol will have to be undertaken. This could easily delay the completion of the standard. However, it is better to publish the standard late than suffer the implementation delays of IS-41 Rev. B.

The compatibility review will have to consider the effect of every new parameter, message and parameter value on both the sending and receiving systems. IS-41 Rev. C systems have to be able to either rely on Rev. A and Rev. B systems taking reasonable default actions, or

be able to detect the incompatibility themselves and take appropriate alternative action.

Next ... Call Delivery Concluded

In our next and final part of our series on inter-system call delivery we shall discuss the toolbox that IS-41 provides to implement call delivery, the messages and parameters that can be used to deliver calls to roamers, to communicate roamer location and to perform a variety of other functions that are required for seamless roaming.◊

Back Issues Available

Back issues are available from July 1992 to the present. Articles in some of our older issues are:

April, 1993 04/93

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

May, 1993 05/93

Where are the Rev. B
Trials?•IS-41 Enables Innova-
tion•A DMH by any other name
would weigh as much...• TR45.2
Project Status• TR45.2 Working
Group VII: PSTN Interface• TIA
TR45.2 Project Status Report.

June, 1993 06/93

Wireless Terminal Location Man-
agement, Part I•Brace for the Stan-
dards Flood•TR-45.2 Working
Group Report.

July, 1993 07/93

ITN Named CTIA Backbone IS-41
Network Provider•New TIA Stan-
dardization Efforts Loom• Wire-
less Terminal Location Manage-
ment, Part II•TR-45.2 Grows More
Tentacles• TR-45.2 Continues to
Pump Standards Out• IS-41 Rev. A
Implementation Status.

The price of a back issue, by mail or
fax, is 10% of your annual subscrip-
tion fee, e.g.:

CDN\$25 Canada

US\$25 United States

US\$30 Other Countries

TR-45.2 Standards Update

TSB-56, the IS-41 Rev. B, IS-53 Rev. 0 and TSB-51 application level test plan is now officially published. Phone Global Engineering Documents for order information (1-800-854-7179 or 1-303-397-7956).

The ballot date for TSB-41 (IS-41 Rev. B Technical Notes) has been delayed until July 8, 1994 due to a missing page in the ballot copies.

The status of the major outstanding TR-45.2 projects follows:

IS-41 Rev. A Compatibility (TSB-55, SP-3063) • In press.

IS-41 Rev. B Test Plan (TSB-56-A, SP-2978) • Published, June, 1994.

IS-41 Rev. B Technical Notes (TSB-41, SP-2985) • In Ballot until July 8, 1994.

Cellular Dialing Plan (IS-52 Rev. A, PN-3166) • Baseline document being reviewed.

Subscriber Features (IS-53 Rev. A, PN-2977) • Verification and Validation is complete. **Balloting delayed** until IS-41 Rev. C is ready for ballot (October, 1994). No action on IS-53 Rev. B (PN-3362).

IS-41 Revision C (PN-2991) • Stage II descriptions have been accepted as baseline. Stage III procedure descriptions and transaction encoding is underway. **Balloting has been delayed until October, 1994.**

International Applications (TSB-29 Rev. B, PN-3173) • Extension of mobile identification beyond 10 digits is a priority item and will be addressed by TR45 in August. Other international problems are a low priority and TSB-29-B will be **completed in 1995.**

Online Call Record Transfer (IS-124 Rev. A, PN-3293) • Revision A of the DMH protocol is a low priority and will be **completed in 1995.**◊

FCC to Investigate Interconnection Obligations

The FCC gave notice on June 9th that it will be investigating the interconnection obligations of Local Exchange Carriers to Cellular and other Commercial Mobile Radio Service (CMRS) Carriers, and whether CMRS carriers should themselves have an interconnection obligation. The aim of the FCC is to ensure that interconnection between telecommunications service providers is available with "safeguards to protect CMRS providers [and other carriers] against unreasonably discriminatory rates, terms or conditions of interconnection".

Interconnection is important for several reasons:

1. It allows a carrier access to subscribers in all other public networks through a small number of points of interconnect.
2. If not regulated it allows dominant carriers to restrict the actions of smaller carriers, including providing preferential interconnection to their own subsidiaries.
3. It allows specialized companies to provide telecommunications services in cooperation with general purposes companies. An example would be a PCS provider that would only provide radio coverage. All telecommunications services, such as the HLR database and call forwarding, would be provided by an interconnected wireline (or cellular) carrier.

In the past interconnect has been seen as a hierarchical relationship between a little carrier and a big carrier (local exchange carrier or inter-exchange carrier) and charges have been unidirectional (e.g. cellular carrier pays local exchange carrier to deliver calls, but is not recompensed when receiving calls). Increasingly, interconnection is being seen as a relationship that may be equal, where both carriers provide services to the other at different times, or which may vary with each call with one carrier playing one role (e.g. HLR) and the other playing a different role (e.g. visited system) depending on the subscriber.◊

TIA TR-45.2 Project Status Report

*Cellular
Networking
Perspectives*

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

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
TSB-56-0 Application Level Testing for IS-41 Rev. A, IS-53 Rev. 0	03/93

Published Interim Standards

IS	Title	WG	Published
IS-41-B	Cellular Radiotelecommunications Inter-System Operations	I	12/91
IS-52-0	Cellular Subscriber Dialing Plan and Service Codes	V	11/89
IS-53-0	Cellular Features Description	V	09/91
IS-93-0	Ai and Di Interfaces Standard (PSTN/MS)	VII	10/93
IS-124-0	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-55	IS-41 Rev. A/B Forward Compatibility	I	(in press)
TSB-56-A	Application Level Testing for IS-41 Rev. B, IS-53 Rev. 0 and TSB-51	II	06/94
TSB-64	Wideband Spread Spectrum Intersystem Operations	I	02/94
TSB-65	Mobile Border System Problems	I	04/94

Projects in Ballot Process (SP = Standards Proposal Number)

SP	Title	Editor	WG	IS/TSB
2985	Technical Notes for IS-41 Revision B	Arzu Çalis	I	TSB-41

Active TR45.2 Projects (PN = TIA Project Number)

PN	Title	Editor	WG	IS/TSB
2977	Cellular Features Description (Rev. A)	Terry Watts	V	IS-53-A
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
3293	Cellular Inter-System Non-Signaling Data Communications	Kirk Carlson	IV	IS-124-A
3295	Ai and Di Interfaces Standard	Mike Buhrmann	VII	IS-93-A
3362	Cellular Features Description (Rev. B)	Terry Watts	V	IS-53-B