Cellular Networking Perspectives

Editor David Crowe • Phone 403-289-6609 • Fax 403-289-6658 Vol. 3, No. 6 June, 1994

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Comments Welcome

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

IS-41 Rev. C Delayed?

The scheduled date to start the ballot process for IS-41 Revision C has been moved back to October, 1994 from July. This reflects the enormous amount of work still required to support IS-53 Revision A features, especially Short Message Service, and the impact of a major reorganization of the document.

A summary of the major enhancements to IS-41 planned for Revision C can be found in the table on page 4. It is quite possible that some planned features will be postponed to prevent further schedule slippage.◊

TSB-41 (IS-41 Rev. B Technical Notes) Out for Ballot

The IS-41 Revision B Technical Notes (TSB–41) have been released to the TIA for ballot. This document defines extensive changes to IS-41 Revision B systems for compatibility with future revisions and to resolve bugs and ambiguities in IS-41 Rev. B.◊

Inter-System Call Delivery, Part IV: Optimizing

In the previous parts of this series on Inter-System Call Delivery we have discussed basic call delivery and the complications caused by features such as call forwarding and complications caused by the US Department of Justice restrictions that apply to most of the large American cellular carriers. In this issue we will focus on optimizations to call delivery, and the reasons (usually not technical) why they are not yet often used.

Optimizing Call Delivery

There are three major ways that intersystem call delivery can be optimized:

1. Monitoring mobile activity.
2. Cellular Gateways.
3. Paging before routing.

Monitoring Mobile Activity

Activity by cellular mobiles can be monitored to determine whether each mobile is probably active or definitely inactive (e.g. turned off or outside any service area). Activity monitoring was discussed in Part III of this series as a way to mitigate some of the problems caused by US Dept. of Justice MFJ restrictions on cellular carriers owned by Regional Bell Operating Company (RBOC). However, mobile activity status is useful to all carriers using IS–41 to reduce the inter-system messaging load when attempting to deliver calls to terminals that are not able to receive calls. Call delivery to an inactive roamer is illustrated in Figure 1. The first call delivery attempt after mobile inactivity is deduced by a

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VLR will cause the normal Routing-Request query of the VLR by the HLR. The VLR will report that the mobile is inactive, allowing the HLR to redirect the call to voice mail. Subsequent call delivery attempts will get no further than the HLR which retains the knowledge that the mobile is inactive. When the mobile announces its presence again at an MSC, a registration will occur which will change the status stored at the HLR back to "Active". An alternative method is to use the IS-41 CSS-Inactive message, but this usually results in more messaging. It is only preferred if the HLR needs up to the minute mobile activity status information to provide additional services beyond call delivery.

Cellular Gateways

Whenever a call is made to a roaming cellular phone three telephone systems are involved; the *originating* system where the call was dialed from, the *home* system (including the HLR) and the *visited* system where the mobile is roaming (VLR/MSC-V). Today, the call traverses two sides of a triangle (from originating system to home system to visited system), requiring two long distance calls. The first long distance leg routes the call from the originating system to the dialed mobile's home system using normal PSTN routing. The second long distance leg routes the call from the home system to the visited system using IS–41 routing. It is possible to traverse just one side of the triangle instead (see Figure 2). IS-41 supports routing directly from the originating system to the visited system, but there are a few problems that have to be overcome:

1. It is difficult to recognize a dialed number as being the address of a wireless subscriber.
2. Cellular carriers want to limit access to their HLR databases.
3. It is difficult to charge for the call.

The Numbers Game

A switch close to the originating caller (not usually a wireless switch) has to recognize the dialed digits as the address of a wireless subscriber. This would currently require an enormous database because cellular numbers are scattered through every area code and many office codes in each area code. Recognizing a dialed number as the address of a wireless subscriber would be easier if an entire area code was allocated to wireless calling (e.g. 1-500 numbers), something that has been resisted due to conflict and uncertainty over the management of the North American Number Plan (see Sept. 1992, Oct. 1992 and Feb. 1993 *Cellular Networking Perspectives* for more details). This problem will not likely be resolved until the FCC hands over numbering responsibility to a more independent group.

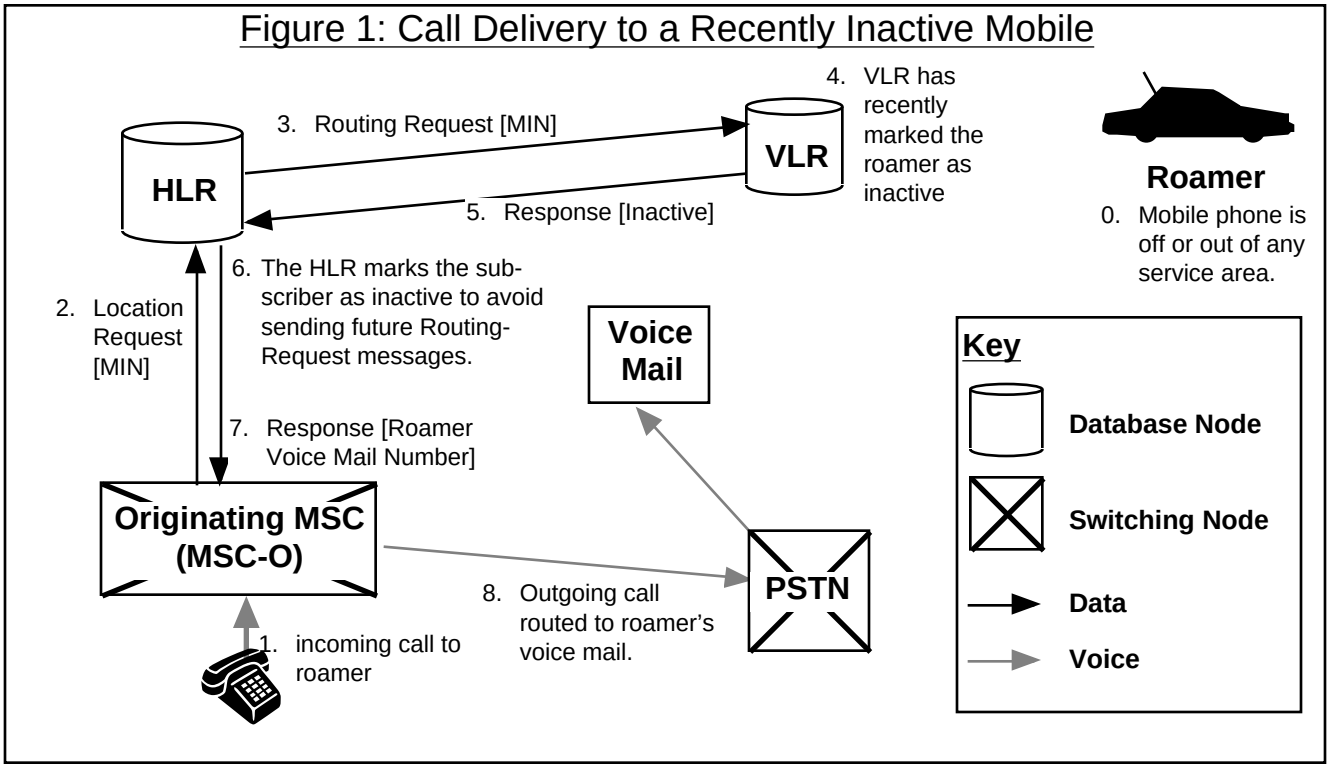
Hands off My HLR!

Although an IS-41 LocationRequest message is legitimately used by a Gateway system to get the information needed to route a call to a mobile, this message could also be used to troll through the HLR database finding out fairly sensitive information about the subscribers on a system. The difficulty in monitoring IS-41 queries of an HLR makes carriers reluctant to open up access. Also, with the home system not participating in the call, the HLR owners want to ensure that they still get some revenue from calls that require access to their subscriber database.

Who Pays What?

In inter-system call delivery today, routing may be inefficient, but it is obvious which party pays for each leg of the call. The caller has dialed a number belonging to the home system and expects to pay for that leg. The roamer has enabled call delivery and expects to pay for extending calls from their home

Figure 1: Call Delivery to a Recently Inactive Mobile



to their current location. If routing is optimized, new charging arrangements have to be made.

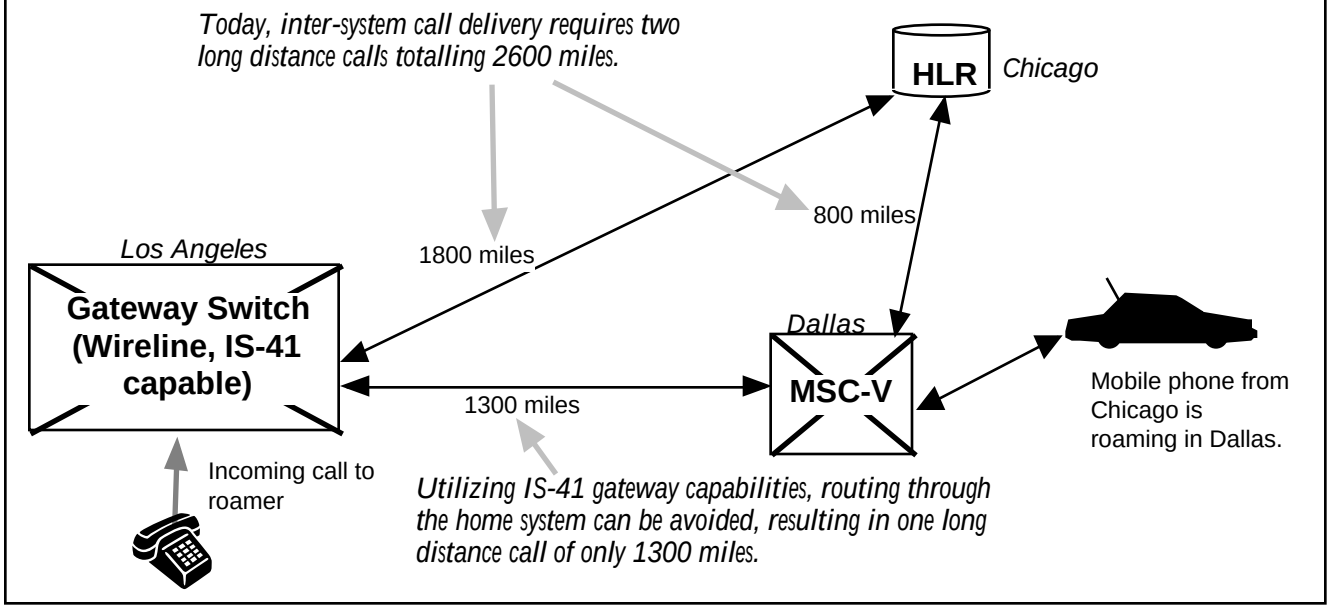
If the calling party is charged for the entire call, the cost may be more than a call to the home system. If the mobile subscriber is charged, the cost may similarly be more than a call from the home system to the visited system. The fairest billing scheme would be flat rate, with either the calling party or the called party paying the entire cost of the single leg required.

Paging Before Routing

Intersystem call delivery normally allocates a TLDN and routes the incoming call to the MSC being visited (MSC–V) before paging the roaming mobile. If the mobile is unavailable, however, this work is wasted. Paging before routing is possible and would allow calls to an unavailable mobile to be redirected to voice mail with less delay and less use of PSTN resources. One reason why this technique is rarely used is because it is not legal in MFJ-restricted systems. Some MSC's (e.g. AT&T) can work in this mode.

There are two reasons why this optimization to call delivery will not likely be used much even if MFJ restrictions are loosened or eliminated. First, it does not eliminate the major problem, which is the length of time that it takes to route a call through the PSTN using a TLDN. This problem can be resolved by using SS7 ISUP signaling, virtually removing the need for this optimization. Also, there is significant overlap between this technique and mobile activity status monitoring, discussed above. Status monitoring has the advantage of lower overhead (e.g. no paging required). Also, the current delay before mobile inactivity is deduced from the absence of an expected registration can be eliminated in newer air interfaces (e.g. TDMA and CDMA digital) that can force mobiles to register at the moment they are turned off.◊

Figure 2: Optimizing Call Delivery with a Wireless Gateway



TR-45.2 Standards Update: IS–41 Technical Notes Out for Ballot as TSB-41

TR-45.2 has released the IS–41 Revision B Technical Notes for ballot as TSB-41. This TSB describes changes required to IS–41 Revision B implementations to resolve incompatibilities between IS-41 systems. These problems stem either from ambiguities in the specification or from inadequate compatibility guidelines for forward and backward compatibility.

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) • In press.

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

Cellular Dialing Plan (IS-52 Rev. A, PN-3166) • Draft accepted as baseline at the May, 1994 TR45.2 meeting. **Balloting will be deferred** until the baseline document has been finalized.

Subscriber Features (IS-53 Rev. A, PN-2977) • Verification and Validation is still underway. **Balloting has been delayed** from May, 1994 until V&V is complete. A **new project** has been started to study features for IS-53 Rev. B (PN–3362); i.e. what gets ejected from Rev. A.

IS-41 Revision C (PN-2991) • Transaction scenarios to support IS-53 Rev. A features are being reviewed. **Balloting has been delayed until October, 1994**.

International Applications (TSB–29 Rev. B, PN-3173) • TR–45.2 is studying several problems with international use of AMPS cellular. This is a low priority project and will be **completed in 1995.**

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. This activity is a low priority and will be **completed in 1995**.◊

TIA Interim Standard IS-41 Rev. C: Summary of Proposed Contents

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IS-41 Revision C Contents (PN-2991)*

Inter-System Operation	Topic	From
Authentication	Terminal Authentication	TSB-51
Encryption	Signaling Message Encryption	TSB-51
	Voice Encryption	
Air Interface Support	CDMA Dual-mode inter-system handoff/authentication	TSB-64
	TDMA digital control channel (DCC)	*IS-54-C*
	TDMA asynchronous data services	*IS-54-C*
Border Cell Problems	Multiple System Paging	TSB-65
	Unsolicited Page Response Handling	
	Filtering Multiple Registration Accesses	
Features	Call Transfer	IS-53 Rev. A
	Conference Calling	(PN-2977)
	Do Not Disturb	
	Selective Call Acceptance	
	Password Call Acceptance	
	Subscriber PIN Access/Intercept	
	Calling Number Identification Presentation/Restriction	
	Message Waiting Notification	
	Short Message Service	
	Remote Feature Control	
	Extension Phone Service: Flexible Alerting/Mobile Access Hunting	
	Preferred Language	
	Priority Access & Channel Assignment	
	Voice Message Retrieval	
International Mobile Identification	Extension of mobile identification to 15 digits	CCITT E.212
Compatibility	Forward/Backward Compatibility Guidelines	TSB-41/
	Unknown message & parameter handling	TSB-55
	Protocol extension guidelines	
	Deregistration - individual/bulk	

*** This list of contents is not fixed, items may still be added or withdrawn by the TR–45.2 subcommittee before publication by the TIA. Items in *italics* are those most likely to be postponed until IS-41 Revision D.**

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Analog Air Interface Standards

Standard	Description (not the official title)	Comment
EIA/TIA-553	Current Analog Air Interface Standard	Published
IS-3	Original Analog Air Interface Standard	now EIA/TIA-553
IS-19	Mobile minimum performance standards	at Rev. B
IS-20	Base Station minimum performance standards	at Rev. A
TSB-39	Message Type Assignment for Extended Protocol	Published
IS-88	Narrowband (3:1) analog air interface ("NAMPS")	Published
IS-89	IS-88 base station performance standards	Published
IS-90	IS-88 mobile performance standards	Published
IS-91	Analog air interface (including "NAMPS" and Authentication)	Ballot
IS-94	In-building analog air interface ("FreedomLink")	Ballot

TDMA Digital Air Interface Standards

Standard	Description	Comment
IS-54-B	Original TDMA Dual-Mode Air Interface Standard	Published
IS-54-C	... Including Digital Control Channel	Development
IS-55	TDMA mobile performance standards	Published
IS-56	TDMA base station performance standards	Published
IS-85	TDMA full-rate voice coder (3:1)	Published
IS-130	TDMA data radio link protocol	Development
IS-135	TDMA asynchronous fax and data air interface	Development
TSB-46	Verification of Authentication for IS-54-B Mobiles	Published
TSB-47	IS-54 Implementation Issues	Published
TSB-50	User Interface for Authentication Key Entry	Published
TSB-61	Authentication Key Mobile Entry Procedures	Published

CDMA Digital Air Interface Standards

Standard	Description	Comment
IS-95	CDMA Dual-Mode Air Interface Standard	Published
IS-96	CDMA Option 1: Voice Coder	Published
IS-97	Base Station minimum performance standards	Ballot
IS-98	Mobile minimum performance standards	Ballot
IS-99	Data Services	Development
IS-125	Option 1: Performance Standards	Ballot
IS-126	Option 2: Loopback	Ballot
IS-127	Option 3: Enhanced Voice Coder	Development
TSB-58	Option Number Assignment	Ballot
TSB-66	Technical Corrections to IS-95	Development

Note: 1. IS- Interim Standard, TSB- Telecommunications Systems Bulletins.

2. **Bold Type** indicates basic air interface standards. Other documents provide options, clarification etc.