Cellular Networking Perspectives

Editor: David Crowe • Phone +1-403-289-6609 • Email crowed@cnp-wireless.com Vol. 9, No. 12 December, 2000

In This Issue...

Price Increase!

Our prices will be increasing in 2001! All renewals received before January 1, 2001 will be honored at the current prices. For more information, please email:

cnpaccts@cnp-wireless.com

Next Issue: January 4th, 2001

3G Standards

3G Wireless Standards development has consolidated into two distinct paths, directed by standards organizations with the confusingly similar names of 3GPP (Third Generation Partnership Project) and 3GPP2 (Third Generation Partnership Project 2). Even the list of partner standards organizations are similar.

3GPP (www.3gpp.org) is populated largely by carriers and vendors that are currently committed to GSM or D-AMPS/ANSI-136 TDMA system. this group has recently taken over responsibility for continuing GSM standardization from ETSI.

3GPP2 (www.3gpp2.org) attracts companies committed to CDMA systems based on ANSI-95 or IS-2000;this group is aiming at future systems with the exotic sounding names of 1XRTT, 1XEV and even, possibly, 1XTREME.

The future for all wireless standards may be CDMA. 3GPP2 is already based on this, and 3GPP plans to move towards Wideband CDMA.

Another future shift will be towards all-IP networks, because of the belief that this network technology can provide higher performance and lower cost, while allowing voice, data and signaling to use the same packet transmission and routing protocols.

To eliminate the confusion over 3G standardization, the past and future of wireless standards organization are illustrated on Page 5.

Optimal Routing, Part II: Optional Routes

The purpose of Optimal Routing, as described in our November, 2000 issue, is to route calls from their originating point directly to the terminating mobile without passing (through) Home. There are several options for the route that is taken to accomplish this;these options vary in important aspects, such as their reliance on new network capabilities, their ability to handle calls not originated by a mobile, and their compatibility with existing systems.

Using MAP

Optimal routing using MAP (GSM or ANSI-41) has long been an option, but it is not often implemented because it requires the system from which a call is being made to be able to recognize the dialed digits as mobile, and it can only optimize mobile-to-mobile calls. In countries where wireless systems are assigned a unique dialing prefix, digit recognition is easy to implement, and it may also be possible within a single carrier network in countries where wireless numbers are not so easy to separate out (such as the United States).

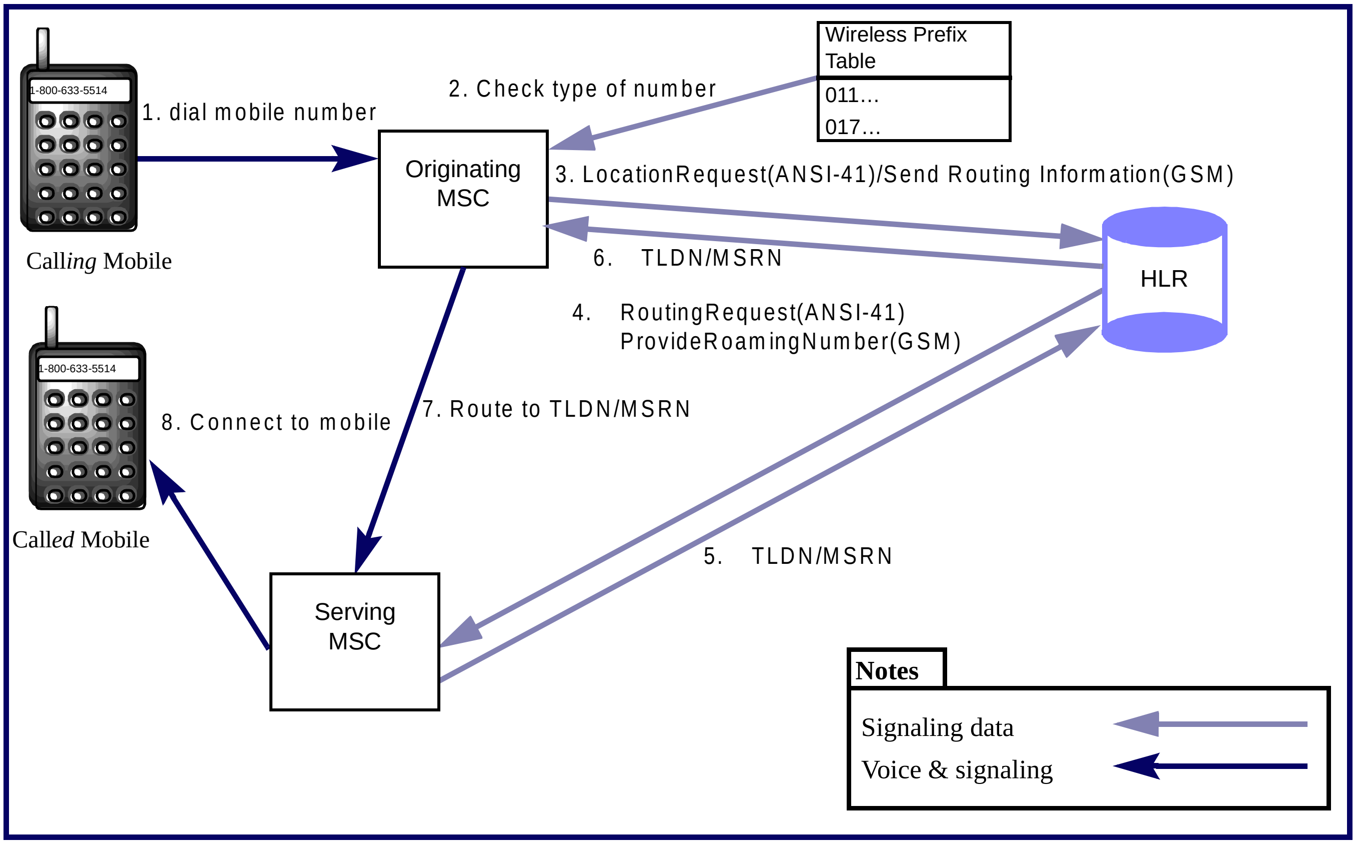
Figure 1 illustrates the use of either GSM or ANSI-41 MAP for optimal routing. The originating MSC has to be able to recognize mobile numbers (step 2), and to support standard MAP call delivery transactions (steps 3-6). When a routing number is obtained (known as a TLDN (Temporary Local Directory

Cellular Networking Perspectives (issn 1195-3233) is published monthly by Cellular Networking Perspectives Ltd., 2636 Toronto Cresc. NW, Calgary AB, T2N 3W1, Canada.
Contact Information: Phone: 1-800-633-5514 (+1-403-274-4749) Fax: +1-403-289-6658 Email: cnpsales@cnp-wireless.com Web: http://www.cnp-wireless.com/.
Subscriptions: CDN$300 in Canada (incl. GST), US$300 in the USA and US$400 elsewhere. Payment by cheque, bank transfer, American Express, Diners Club, MasterCard or Visa.
Delivery: Email or 1st class mail. Back Issues: Available individually for $35 in the US and Canada and $40 elsewhere, or in bulk at reduced rates. Discounts: Educational and small business discount: 25% off any order. Copies: Each subscriber is licensed to make up to 10 copies of each issue or back issue. Please call for rates to allow more copies.

Number) in ANSI-41 and as an MSRN (MS Roaming Number) in GSM), the call can then be routed directly to the current serving MSC (step 7) and to the mobile (step 8).

This solution is only applicable to mobile originating calls (or the currently unlikely case of a landline switch that supports a subset of MAP), and assumes wireless numbers cannot be ported (whether to another wireless carrier or to a landline carrier).

Figure 1: Optimal Routing using GSM or ANSI-41 MAP



Number Portability

Number portability already requires the ability to query a database (NPDB), to obtain the LRN (Location Routing Number) for ported phone numbers (see our May, June and July 1999 issues for a discussion of number portability). A minor modification to this database would enable the type of number (e.g. ANSI-41 MAP, GSM MAP, other) to be included in the response to the query, whether the number was ported or not.

Apart from requiring modifications to the number portability database, it would also require modifications to the protocols that query it (e.g. the ANSI-41 NumberPortabilityRequest message), it would require queries outside the local portability region, and it would require all blocks of numbers to be included in the database, even those containing no ported numbers.

Figure 2 shows how optimal routing could use number portability queries. The major difference from the standard MAP method (highlighted in the shaded oval area) is that an external database (NPDB) is queried instead of an internal table.

A big reason why this solution is a long shot is because US wireless carriers are still hoping to avoid having the number portability mandate applied to them. Another is that the portability infrastructure is so unwieldy, any non-essential change is likely to be rejected.

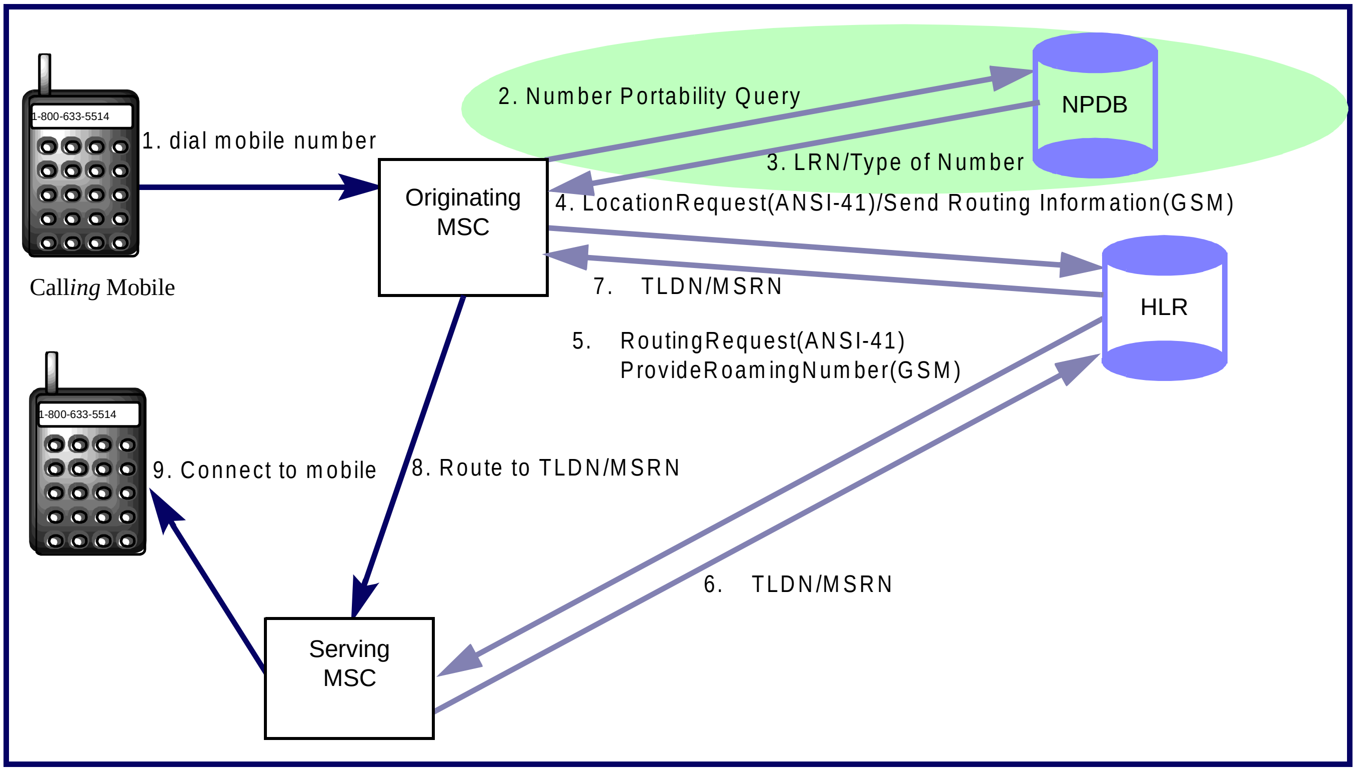
Even if implemented, this method of optimal routing would only work if both the originating and terminating switches supported number portability, and if the originating switch and the NPDB support this new field. Also, the originating switch must be able to determine the network address of the NPDB for the given terminating number. .

Enhanced Roamer Agreement Tables

When a roaming mobile makes a call in ANSI-41 cellular or PCS systems, it provides its MIN or IMSI to the serving system (or a TMSI, which can be mapped into a MIN or IMSI). This identifier allows the HLR to be addressed, which then allows the presence of the mobile to be reported through a Registration-Notification operation, which in turn allows future call delivery.

These Roamer Agreement Tables are already close to providing the information needed to determine whether or not mobile originated calls are to another mobile on a compatible network. When the MIN of a mobile is the same as its directory number (MDN), the corre-

Figure 2: Optimal Routing using Number Portability



sponding record from the Roamer Agreement Table could be used directly to obtain the network address of the HLR, to which a LocationRequest could be sent.

In general, the MIN of a mobile is not the same as the MDN, and even when a simple mapping between the two identifiers exists, it is not the same in every country. Consequently each entry in this table would (should) be updated with the corresponding MDN prefix for call delivery as well as the MIN prefix for originations. The MDN prefix identifies a group of mobiles sharing a contiguous block of numbers (e.g. the prefix 403-870 could be used to represent the ten thousand mobiles with numbers from 403-870-0000 through 403-870-9999).

Figure 3 illustrates how Enhanced Roamer Agreement Tables could facilitate optimal roaming. This method is similar to the first method described, but it is easier to support in countries with complex mobile numbering plans, such as the United States, because it works by enhancing an existing data table, rather than by creating another large table and the corresponding huge data management burden.

The critical difference between the first two methods (highlighted by the shaded oval area) is the Roamer Agreement Table is queried at step 2. This table does not need to store the type of number, as all numbers in this table are mobile (ignoring the impact of number portability). The absence of an entry identifies a number to which this method of optimal routing does not apply.

This method only works with mobile originated calls, it is not fully compatible with number portability, and it is not compatible with GSM systems, which do not usually keep a Roamer Agreement Table.

Release-to-Pivot (RTP)

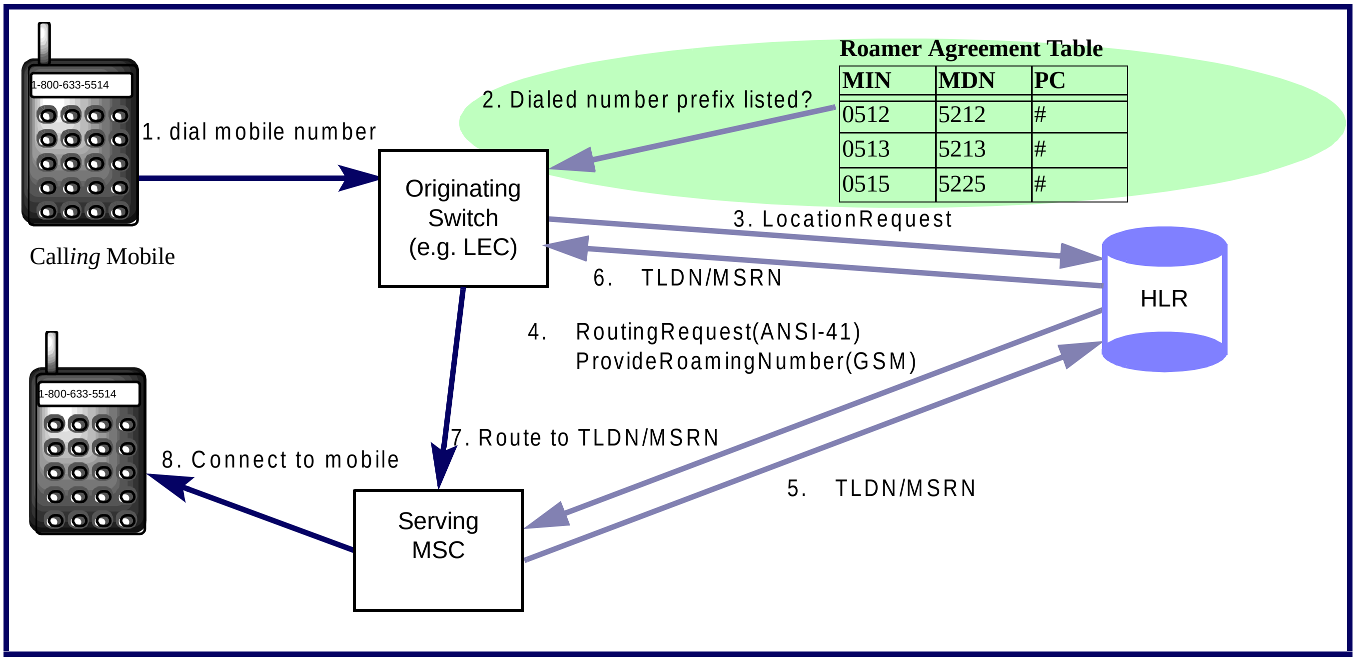
The most general purpose method for implementing optimal routing takes a completely different approach. Because of this, it can apply to land-to-mobile calls, and it is not affected by number portability.

Release-to-Pivot (RTP) is a general concept allowing a call routed to one switch to be redirected to another, This allows the trunking to be re-originated from the beginning point of the call. This can optimize trunking for call forwarding, for directory assistance with call completion and for wireless optimal routing.

Figure 4 shows how Release-to-Pivot can be used to implement optimal routing. The originating switch indicates its ability to support RTP in an SS7 ISUP IAM call setup message. The Home MSC performs the normal ANSI-41/GSM process to obtain a temporary routing number (steps 3-6). However, instead of directly routing the call to the Serving MSC, the Home MSC releases the incoming trunk (at step 7) – with a caveat – the call must be re-originated to the number provided (the temporary routing number, TLDN or MSRN). The originating switch can then extend the call to the Serving MSC. If, for any reason it does not want to perform this function (e.g. lack of a billing agreement), it can reject the release, and the Home MSC will have to extend the call normally, although without optimal routing.

Release-to-Pivot has one serious limitation – it fails to work with some types of call forwarding. If a call is forwarded to a serving MSC through release-to-pivot, but the mobile does not answer or does not respond to a page or is busy, it is now impossible to route the call back to the

Figure 3: Optimal Routing using Enhanced Roamer Agreement Tables

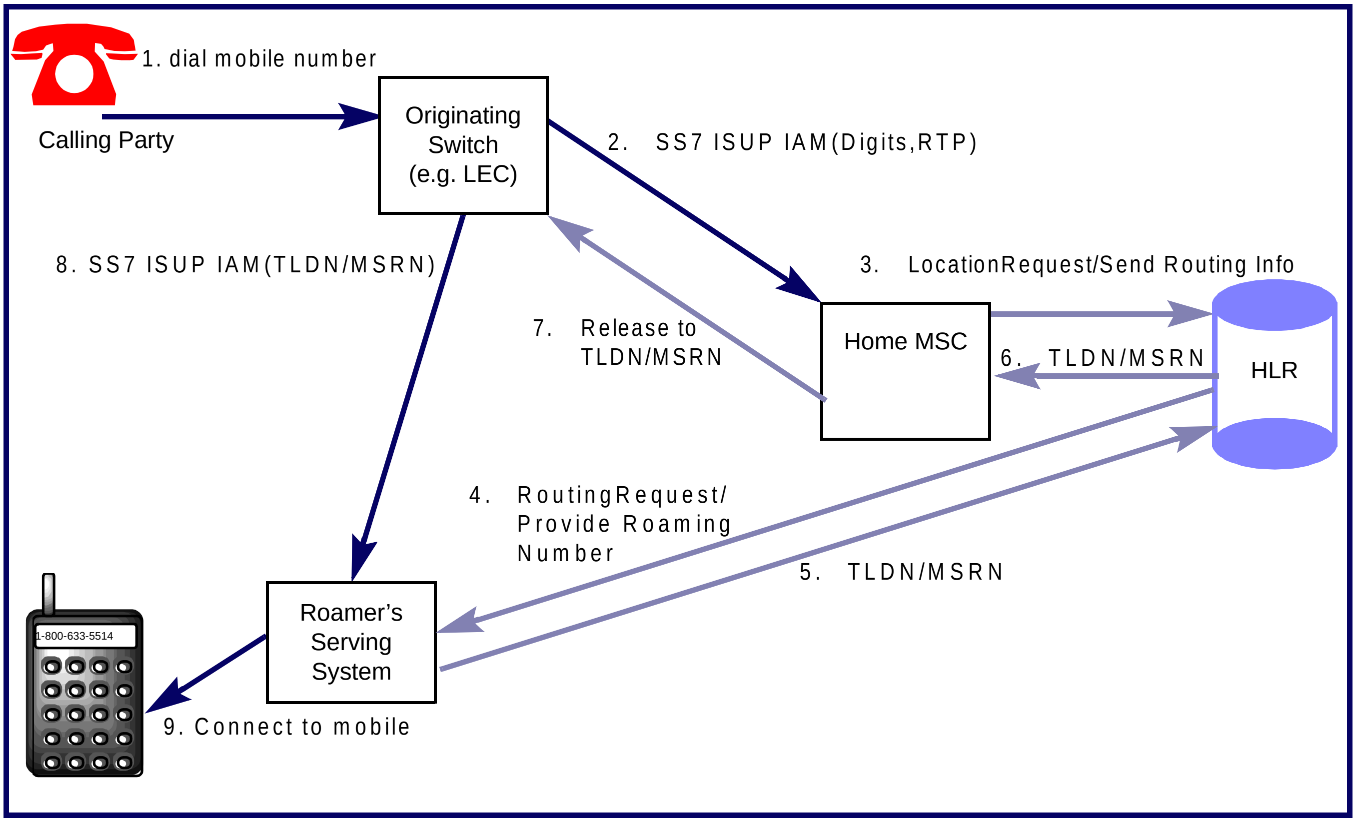


home system where a new route can be selected (e.g. call forward no answer number). To overcome this problem, an enhanced form of Release-to-Pivot will be required, which we call Conditional Release-to-Pivot (cRTP).

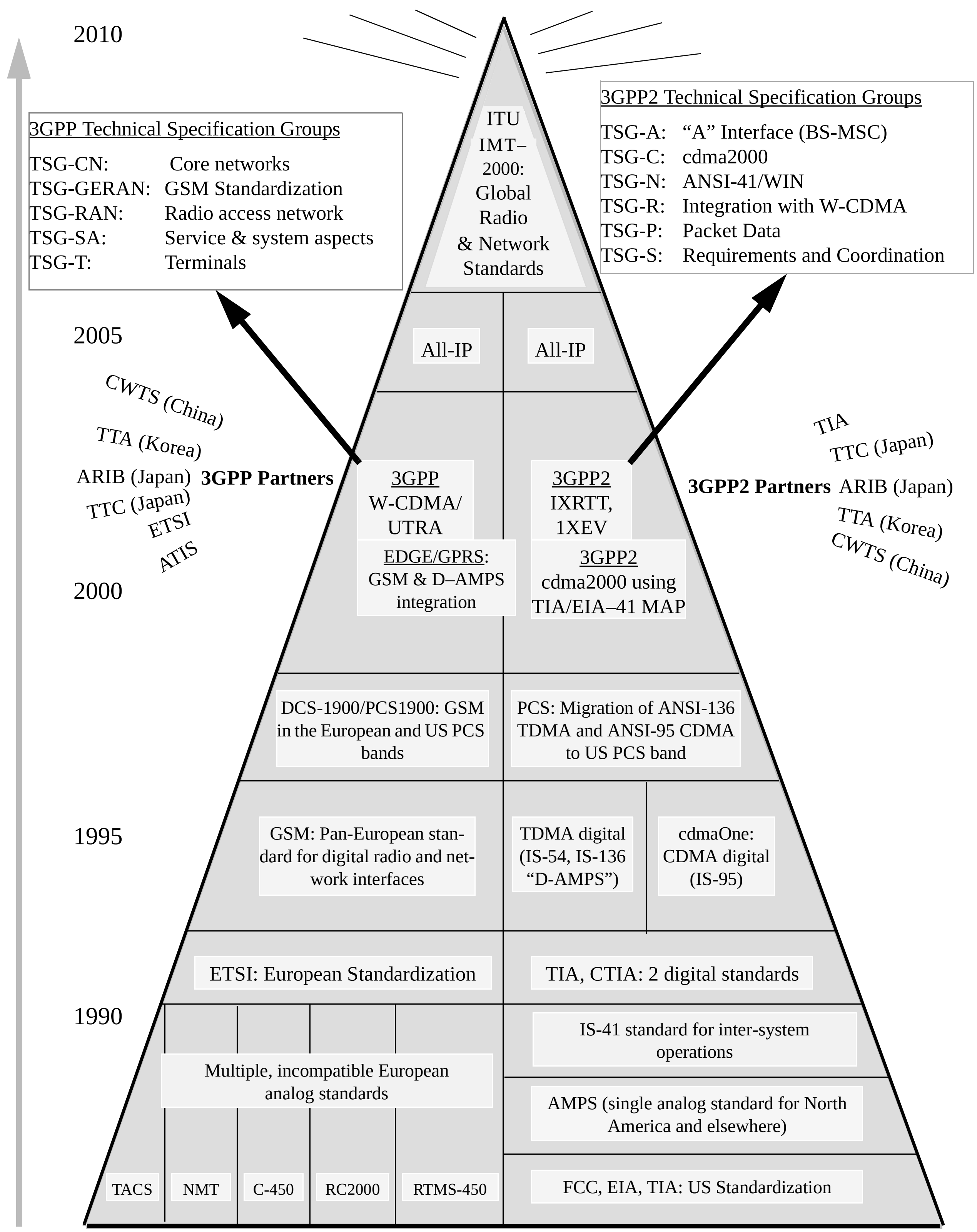
To be continued...

We will conclude our discussion of optimal routing with an exploration of how Conditional Release-to-Pivot can be used to provide seamless optimal routing from any phone served by an SS7 ISUP capable switch to any mobile.

Figure 4: Optimal Routing using Release-to-Pivot



The Evolution of Wireless Standards to 3G



For definitions of acronyms see: www.cnp-wireless.com/glossary.html

TIA TR-45.6 and TSG-P Adjunct Wireless Packet Data Standards

Cellular Networking Perspectives

Editor: David Crowe • Phone +1-403-289-6609 • Email crowed@cnp-wireless.com

Last published December, 1999

CDPD - Cellular Digital Packet Data

Standard	Project	Description	Status
IS-732	PN-4033	Cellular Digital Packet Data (CDPD) - multiple parts	Published 02/98
TSB-87	PN-4001...	CDPD Support Services (Directory, Authentication, DNS, Testing, Identifiers, Numbering)	Published 02/98

CDPD - Cellular Digital Packet Data (Revised)

Standard	Project	Description	Status
TIA/EIA-732	**SP-4033-UG**	**Revisions to CDPD and upgrade to ANSI**	**Development**

3G Packet Data

Standard	Project	Description	Status
IS-835	**PN-4732**	**cdma2000 Wireless IP Network Standard. Waiting for IETF RFC number before publishing**	**In press**
TSB-115	**PN-4286**	**cdma2000 wireless IP architecture based on IETF protocols. Waiting for RFC number from IETF**	**In press**

TSG-N Projects

Standard	Description	Status
P.R0001	**Wireless IP Network Architecture. Same as TSB-115**	**Published 07/00**
P.S0001	**Wireless IP Network Standard. Same as IS-835**	**Published 12/99**
P.S0001-A	**Wireless IP Network Standard. Same as IS-835**	**Published 07/00**
P.S0001-A-AD1	**Addendum to P.S0001-A**	**Development**
P.S0001-B	**Wireless IP Network Standard. Same as IS-835**	**Development**
P.xxxx	**All IP Core Network**	**Development**

Note:
1. IS- Interim Standard, TSB- Telecommunications Systems Bulletin, PN- Project Number, SP- ANSI Standards Proposal.
2. Bold Type indicates a modification since the previous publication of this information.
3. Published TIA standards can be obtained from Global Engineering Documents at 1-800-854-7179.

Thanks to Ed Campbell (3Com) and Haeng Koo (Samsung) for their assistance compiling the information in this table.