Cellular Networking Perspectives

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

Next Issue: February 2, 2000

Australia's Y2K Problem

Australian users of the analog (AMPS) cellular telephone system had a major Y2K problem, which started on December 31, 1999. According to Australian legislation, analog cellular service must now be phased out in favor of digital systems, existing GSM systems and new systems based on CDMA technology. The Australian Communications Authority (ACA – www.sma.gov.au) stated that "The analogue mobile phone network closed in most metropolitan and regional areas on 31 December 1999. In remaining regional areas, as well as the Northern Territory and Tasmania, the network is continuing after 31 December 1999, but will close during the year 2000."

According to Boyd Munro of APUMP (Association for the Protection of Users of Mobile Phones Pty. Ltd. – www.apump.com) on December 31, 1999 - "There are huge areas of regional Australia where you can now use a mobile phone to call the ambulance. After the analogue network is closed, you won't be able to do that because there will be no mobile phone service at all." While the Australian government has stated that "every area of Australia which currently receives mobile phone coverage from the Telstra analogue network will continue to receive the same coverage when the network is upgraded [to CDMA]", but the ACA has also stated that "Australians are entitled to reasonable access to fixed telephone services under provisions of the Telecommunications Act 1997, but this does not apply to the supply of mobile phone services. In general, mobile phone carriers make decisions on a commercial basis about the location of base stations for mobile phone coverage", which is considerably less comforting for people with analog phones. Even if analog coverage is maintained in rural areas due to a lack of digital coverage, it will still mean that Australians who travel between rural and urban areas will need to purchase a new phone to maintain the same level of coverage in 2000 as in 1999 – either a digital phone to supplement their analog phone, or a dual-mode analog/CDMA phone as a replacement.

The problem for rural Australians is that analog cellular provides significantly greater coverage from a base station than GSM digital (10 times the coverage area under common rural conditions), and that the new CDMA systems are immature (or not yet operational) and their rural coverage capabilities unproven. The greater capacity provided by digital cell sites is of little use in rural areas.

The Australian situation was also covered in our February 1998, October 1998 and March 1999 issues.

...and Korea's too

SK Telecom of Korea also shut down its analog network on January 1, 2000 in favor of CDMA, although there were only about 2,000 customers left by the end of 1999, compared to an estimated 1 million on Telstra's Australian analog network.

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, 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.

Wireless TTY Forum Technical Status Report

A December 2, 1999 report from the Wireless TTY Forum outlines possible methods for connecting TTY/TDD devices to digital wireless systems. While the TTY modem tones are passed through analog cellular systems without significant problems, digital voice coders distort the tones, creating a very high error rate. These issues are discussed in our May, 1998 and March, 1999 issues.

The TTY forum has identified several solutions, classifying them as Voice Based Solutions, Modified Vocoder Solutions and Data-Vocoder Bypass Solutions.

Voice Based Solutions

With a voice-based solution, the TTY device would connect to the digital wireless device, using an unmodified voice coder. The performance of this approach is unlikely to be as great as those using modified voice coders, or even eliminating the voice coder, but they will be more adaptable to existing phones.

A direct audio connection using a 2.5 mm jack is considered to be the most promising voice based solution. Issues with differing audio input and output levels are being examined by TIA subcommittee TR-45.1 under project PN-4558 (see page 6). This work is related to the work the subcommittee is doing on an automobile interface for wireless phones (e.g. IS-798-A).

There are also a number of proprietary solutions mentioned in the report, including an acoustic coupler solution developed by Ericsson, although they have much less momentum.

Modified Vocoder Solutions

Since the digital voice coder (vocoder) is the problem with TTY, having a voice coder that can adapt to the transmission of TTY information is a potential solution. The Lucent "No Gain" solution requires relatively minor adaptations to existing voice coders, and is described in our March, 1999 issue. More recently, two other solutions have also been proposed. A Nokia proposal replaces the voice coder with a special TTY tone coder for TTY calls. A Motorola proposal (for CDMA only) proposes to use the secondary channel to transmit TTY signals in a digital format, with whatever is being transmitted on the primary channel being ignored.

The Lucent "No Gain" solution is the modified vocoder solution currently preferred by the TTY forum, and is already being standardized by both TR-45.5 for CDMA systems and TR-45.3 for TDMA (D-AMPS) systems. Technology choices have not been made for GSM and iDEN.

Data-Vocoder Bypass

The ideal solution to the TTY problem would be to have the TTY device initiate digital signals, and not audio tones. These signals could pass through the digital wireless phone in a manner similar to data (e.g. no voice coder present). This will require an inter-working function at the base station or switch site, to convert the digital information into clean TTY tones before interconnecting with the PSTN. This is a long term solution, requiring standardization and implementation of changes to TTY devices, phones, base stations and MSC's.

Moving forward…

According to Ed Hall, CTIA's Assistant Vice-President for Industry Relations and chairman of the TTY forum, "This report represents due diligence by the industry and has been totally supported by all the stakeholders – the deaf and hard of hearing community, Public Safety, wireless carriers and manufacturers, TTY equipment manufacturers as well as the FCC. I foresee carriers developing implementation plans within the year."

Comments

We welcome comments on the format or contents of *Cellular Networking Perspectives*. We can be reached via email at:

cnpsales@cnp-wireless.com

Calling Party Pays (CPP) Part II: Implementation Alternatives

In our December, 1999 issue we described the CPP service, and sketched the political environment surrounding this service. Four different approaches to implementing it were identified. In this article we describe each in detail, along with the major advantages and disadvantages of each.

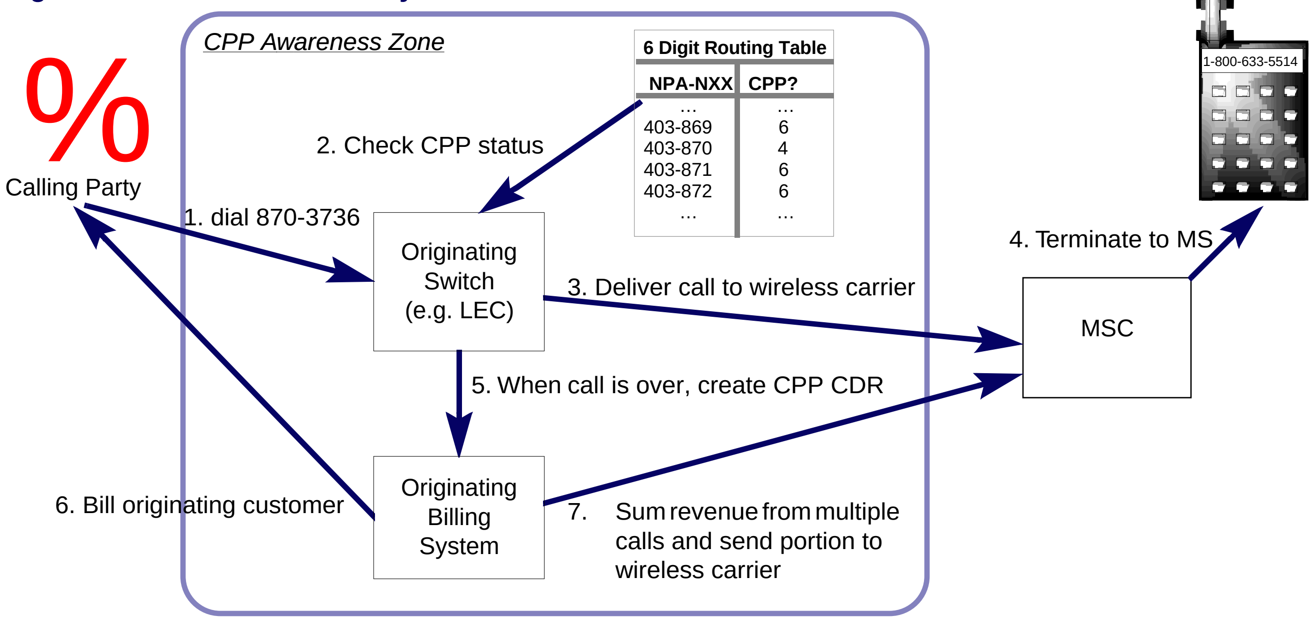
CPP Determined by Number Block

Traditional CPP solutions are based on recognizing that a call is CPP from the dialed digits. In countries (such as most European countries) where there are few carriers, where wireless carriers are assigned unique carrier codes (equivalent to an entire area code in the North American Numbering Plan) and where CPP is mandatory – it is easy for switches to recognize when a call should be treated as CPP based on simple digit analysis. Compensation to the wireless carrier can even be handled through interconnect agreements, no special settlement process is required. Carriers can simply pay the wireless carrier a portion of the per-minute CPP charges for terminating traffic.

In North America, these solutions are not applicable because there are many carriers of all types, wireless carriers are not assigned large blocks of numbers from the top of the numbering plan, but small blocks (generally 10,000 numbers at a time) from the bottom. Also, CPP cannot be made mandatory as business users in particular would probably object to any system that forced potential customers to pay to call them. Consequently, North American CPP systems have generally been implemented through the allocation of blocks of 10,000 numbers.

Billing for this service is provided by the originating Local Exchange Carrier (LEC), as the caller is assumed to be one of their customers. A portion of the revenue that is collected is forwarded to the

Figure 1: CPP Determined by Number Block



wireless carrier through a settlement process.

The compromises necessary to make this method work severely limit its capabilities. The most notable deficiencies are:

1. Calls can only be processed from within the local calling area, as other areas will not maintain the tables of NPA-NXX codes necessary to distinguish CPP number blocks from others.
2. Calls can only be made from a carrier with an agreement with the terminating wireless carrier. This probably means that calls from competing wireless carriers and competitive LEC's will not be handled as CPP.
3. Changing from CPP to TPP (Terminating Party Pays) requires a change of phone number.
4. The service is not compatible with number portability unless an exemption is granted for this service. CPP customers would have to change their phone numbers to port to another carrier, even if that carrier also supports CPP to ensure that CPP revenue is directed to the correct carrier.
5. The service is controlled by the originating carrier (usually a LEC), which gives the terminating wireless carrier little control over the specific rate charged and the information provided to the caller.

Figure 1 shows how calls using this method are processed. The *CPP Awareness Zone* indicates the parts of the network that need to be aware that the call being processed is Calling Party Pays.

CPP through ISUP Signaling

During the CTIA evaluation of CPP in a North American context the wireless industry participants agreed that they could not accept all the limitations of existing CPP services (see previous section), especially the lack of control over what they consider to be a wireless service. The CTIA Standards Requirement Document recommended that new and existing SS7 ISUP signaling parameters be transferred from originating switch to terminating wireless switch (MSC) to determine whether a call can be processed as CPP or not:

1. Originating Line Information (OLI)

   This existing parameter, also known as ANI-II, identifies the type of calling line, allowing an MSC, for example, to determine that CPP is not applicable to calls from payphones, hotel/motel and prison phones.
2. Originating Carrier Identity

   This identifies the company responsible for billing the caller, and can be used to determine whether a billing agreement exists, and to determine where the bill should be sent. The parameter to be used to convey this information will probably be the new Local Service Provider Identity (LSPI) that is already being developed for other purposes.
3. CPP Billing Indicator

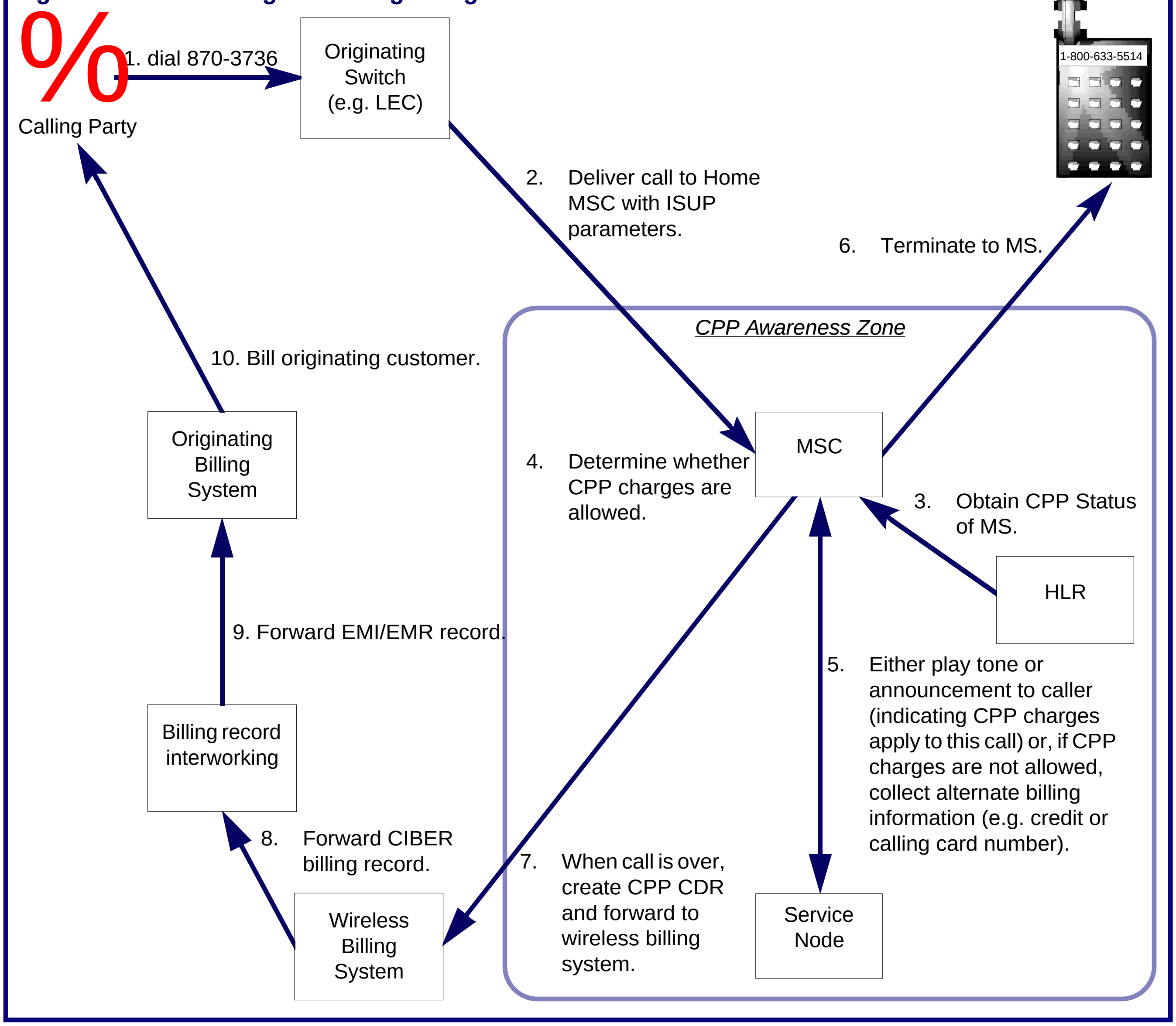
   This parameter will indicate whether an individual line has been blocked from making CPP calls. It has not yet been proposed to the ATIS T1S1 committee for standardization.

It is important to note that these parameters must be transmitted end-to-end for all calls, because the originating carrier does not know which calls will be CPP, and which will not be (i.e. the originating carrier is outside the *CPP Awareness Zone*).

This method for handling CPP calls has some great advantages:

1. It is not dependent on recognizing dialed digits, resulting in several benefits:
   i. Customers can subscribe to CPP (or unsubscribe) without changing their numbers.

Figure 2: CPP through ISUP Signaling



ii. It is compatible with local number portability.

iii. It can be made available nationally or even, with proper SS7 interworking, internationally.

2. It is controlled by the wireless carrier, allowing billing based on individual subscriber profiles, for example.

However, this method also has some significant problems:

1. The new signaling parameters must not only be standardized, but must be implemented by all originating carriers and inter-exchange (long distance) carriers. There is little motivation for carriers to go to this expense unless they are handsomely compensated by wireless carriers or forced to by FCC rules.
2. CPP calls from selected PBX lines cannot be blocked unless the PBX is upgraded to initiate the CPP Billing Indicator parameter, which requires further standardization, development and widespread upgrades, with no business motivation for the PBX owners.
3. The problem of handling calls from payphones is not resolved, and may be made even worse, as even LEC-controlled payphones cannot be made aware of CPP charging.

Figure 2 illustrates the processing of a call using this method.

To be continued...

In the third part of this article, we will describe a solution that uses LIDB database queries instead of ISUP signaling, discuss an ‘ideal’ solution for CPP, assuming that the development of new standards is not a barrier, and provide a comparison table of the four different approaches to implementing CPP.

TIA TR-45.1
Analog Cellular
Air Interface Standards

Cellular Networking Perspectives

Editor: David Crowe • Phone +1-403-289-6609 • Email crowed@cnp-wireless.com *Last published July, 1999*

First Generation - Basic Analog

TIA Standard	Description	Status
EIA/TIA-553 Rev. 0	Analog air interface	Published 09/89
IS-3- A,B,C,D	Original analog air interface standards (see EIA/TIA-553-0)	Rescinded 09/89
IS-19-B	Mobile minimum performance standards	Published 06/88
IS-20-A	Base station minimum performance standards	Published 06/88
TSB-35	Cellular mobile receiver dynamic range	Published 04/92
TSB-39	Message type assignment for extended protocol	Published 03/93

Second Generation - NAMPS, In-Building, Residential, Authentication

TIA Standard	Description	Status
IS-88	Narrowband (3:1) analog air interface (“NAMPS”)	Published 02/93
IS-89	IS-88 base station performance standards	Published 02/93
IS-90	IS-88 mobile performance standards	Published 02/93
IS-91	Analog air interface (including “NAMPS” and authentication)	Published 10/94
IS-94	In-building analog air interface (“CAPS”)	Published 05/94
IS-680	Residential (“cordless”) interface between Wireless Residential Extension (WRE) and PSTN	Published 05/96
TSB-70	**Cross reference for FSK control channel**	**Published 12/95**
TSB-83-A	Additional modem options for IS-680 (“cordless”)	Published 04/97

Third Generation - Isolation of “Core” Control Channel Capabilities

TIA Standard	Description	Status
TIA/EIA-553-A	**Analog air interface (including authentication, alert/flash with info, abbrev. alert, message waiting indicator and protocol capability indicator (PCI))**	**Published 11/99**
TIA/EIA-690	**Mobile minimum performance standards (previously IS-19-C)**	**In press**
TIA/EIA-691	**Enhanced analog ANSI version of IS-91-A (without Wireless Residential Extension)**	**Published 11/99**
TIA/EIA-712	Base station minimum performance standards (prev. IS-20-A)	Published 09/97
IS-91-A	**Revised IS-91 air interface (including IS-94 functionality and sleep mode)**	**Published 11/99**
IS-713	**1900 MHz upbanded AMPS (based on IS-91-A)**	**Published 11/99**
TSB-39-A	**Message type assignment for extended protocol (analog, TDMA and CDMA standards)**	**Published 10/94**
TSB-70-A	**Updated version of TSB-70 cross reference**	**Published 9/99**
TSB-71	IS-94 enhancements and issues	Published 10/95

Fourth Generation - Advanced Capabilities

TIA Standard	Project	Description	Status
TIA/EIA-89	**PN-4658**	**Elevate IS-89 to ANSI standard**	**Development**
TIA/EIA-90	**PN-4659**	**Elevate IS-90 to ANSI standard**	**Development**
IS-91-B	**SP-3666**	**Revised version of IS-91 (including IMSI, OTA, priority access, 9-1-1, cryptosync and Expanded ESN)**	**Cancelled**
IS-788	**PN-4205**	**Portable wireless phone to vehicle interface - Connector**	**Published 6/99**
IS-788-A	**PN-4660**	**IS-788 including IDB**	**Ballot**
IS-789	**PN-4207**	**Portable wireless phone to vehicle interface - Electrical Interface**	**Published 7/99**
IS-789-A	**PN-4629**	**Modification to IS-789 to support SAE J2366 ITS Data Bus (IDB)**	**Ballot**
IS-790	PN-4208	Portable wireless phone to vehicle interface - Latch	Development
IS-791	PN-4209	Portable wireless phone to vehicle interface - Test Specifications	Development
IS-798	**PN-4527**	**Portable wireless phone to vehicle interface: Mounting Envelope**	**Ballot**
IS-817	**PN-4662**	**Geo-location for analog cellular phones**	**Development**
IS-822	**PN-4560**	**"+" (Plus Code) dialing for international calling from analog cellular phones**	**Development**
IS-xxx	**PN-4204**	**Portable wireless phone to vehicle interface - Architecture**	**Development**
TSB-119	**PN-4559**	**"Intelligent Retry" for improved access to emergency calling (formerly scheduled to be IS-821)**	**Development**
	PN-4373	Analog Air Interface Support of Expanded ESN (56 bit ESNX)	On hold
	PN-4375	Analog Air Interface Support of International Mobile Station Identity (IMSI)	On hold
	PN-4558	**Interface between wireless phone and Telephony Device for the Deaf (TDD)**	**Development**
	PN-4630	**IDB message set definition for IS-789**	**Development**

Note:
1. IS- TIA Interim Standard, TSB- TIA Telecommunications Systems Bulletin, PN- TIA 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 purchased from www.tiaonline.org.

Thanks to John Kay (Motorola, Chairman of TR-45.1) for his assistance compiling the information in this table.