Industry Notice:

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3RD GENERATION PARTNERSHIP PROJECT 2 "3GPP2"

3GPP2 Industry Notice:

Null Packet Zone Identifier

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1 The Problem

Recently, there have been a number of reports that cdma2000®[1] 1x mobile stations are not reconnecting a dormant packet data service following the release of a voice or data call during which the mobile station moved into a new packet zone during the call. This can result in the inability for the network to deliver network-initiated packet data to the mobile station.

This industry notice identifies the problem and the solution chosen by TSG-C. It further describes the impact of the solution upon deployed base stations and mobile stations.

2 Packet Data Service Architecture

The packet data service architecture is shown in Figure 1.

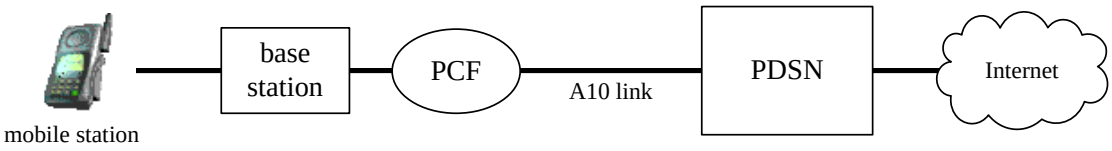

Figure 1 Packet Data Service Architecture

The mobile station connects to the base station over-the-air, and the base station connects the mobile station through a PCF and PDSN to the Internet. When the mobile station's packet data service is connected, all links are connected; when the mobile station's packet data service is dormant, only the A10 link is connected, as shown in Figure 2.

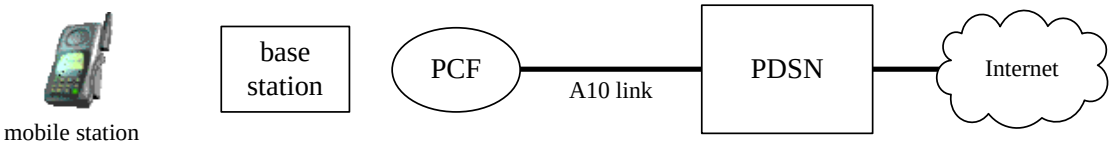

Figure 2 Packet Data Service Links during Dormancy

3 Dormancy and Mobility

During dormancy, when packet data arrives at the PDSN from the Internet, it is relayed to the PCF using the A10 link. The PCF contacts the base station to initiate paging procedures to contact the mobile station, and when the mobile station connects to the base station, the packet data from the Internet is delivered to the mobile station. If the paging procedure fails, and the mobile station does not connect to the base station, the data cannot be delivered.

It is therefore important that the mobile station is located in the area corresponding to that covered by the paging procedure for a specific PCF. The area served by a PCF is known

[1] cdma2000® is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2. Geographically (and as of the date of publication), cdma2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States.

as a packet zone, and is represented by a packet zone identifier (PZID) which is broadcast by the base station in several overhead messages. The PZID is also sent in a number of handoff messages. During dormancy, when a mobile station moves into an area served by a different PCF, it initiates a mobility origination[2] to inform the network of its previous location. This triggers repositioning of the A10 link from the previous PCF to the new PCF.

If the mobile station moves into an area served by a different PCF during a voice call, and either the mobile station or network does not support concurrent services[3], the mobile station must defer informing the network until the voice call is released.

4 A10 Connectivity During a Packet Data Call

During a packet data call, the mobile station is on the traffic channel and does not receive overhead messages. During the call, it is possible that the mobile station will move into an area served by a different base station. When this occurs, the air interface performs a handoff from the current serving base station to the new serving base station. During this handoff, the network can choose to move the A10 link to the new serving PCF if the new base station is served by a different PCF.

Alternately, the network may use implementation specific means to maintain connectivity to the current serving PCF.

Some network implementations that do not physically move the A10 link between the PCF and PDSN during handoff to a new base station rely on a subsequent mobile station mobility origination following call release to trigger relocation of the A10 link. These networks expect that the mobile station will detect that it is in a new packet zone when the call is released and the mobile station again receives overhead messages.

5 The Mobility Origination Dilemma

Unfortunately, if either of the following occurs, the mobile station may not perform this mobility origination.

- the mobile station receives a handoff message that includes the PZID of the packet zone that the mobile station is entering, or
- following a handoff, the mobile station receives an *In-Traffic System Parameters Message* (ITSPM) that includes the PZID of the packet zone that the mobile has entered.

If the mobile station updates its internal location parameter information when it receives a handoff message or an ITSPM, it will not recognize a change in location if the call is released while the mobile station is in the packet zone identified by the PZID in the message. When the network moves the A10 connection during handoff, this is the desired result, and so updating its internal location parameters is the correct action for the mobile

[2] A mobility origination's sole purpose is to report a change in location. The message used by the mobile station includes information identifying the previous packet zone in which the mobile station last reported its location.

[3] If both the network and mobile station support concurrent services, the mobile station may initiate a mobility origination.

station to take. In fact, if the mobile station does not update its internal location parameters, it will perform an additional, unneeded mobility origination when the call is released.

However, updating internal location parameters is incorrect if the network has not moved the A10. In this case, if the mobile station does not perform a mobility origination, the A10 link will remain terminated at the original serving PCF, and the base station associated with that PCF may no longer be able to reach the mobile station using its paging procedures. In this case the correct action is to not update the internal location parameters.

The mobile station's handling of a handoff message or an ITSPM is not currently specified by the data services specification. Both ways of dealing with the messages are presently allowed. Also, it is impossible for the mobile station to determine if the network moved the A10 connection during handoff. So the mobile station cannot be certain which of the two actions it might take is correct.

6 The Solution

TSG-C has determined that a new capability is required in order to support all network implementations. The capability must allow the network to indicate in a handoff message and in an *In-Traffic System Parameters Message* whether or not the mobile station should update its internal location information for packet data service.

Since the packet zone identifier is included in overhead messages, in the ITSPM, and in handoff messages, TSG-C intends to use an existing packet zone identifier value to indicate to the mobile station that it should not update its internal location parameters. For this purpose, TSG-C has selected the packet zone identifier with value 254[4] to represent the *Null* Packet Zone Identifier (*Null* PZID).

In addition, the network is prohibited from including the *Null* PZID in any overhead message broadcast by the base station. This ensures that even if a mobile station stores the *Null* PZID as a location parameter, it will not match any packet zone identifier broadcast in an overhead message.

In addition, TSG-C will add procedures to the packet data service specification for correctly processing a received handoff message and ITSPM.

7 Impact on Deployed Equipment

If a network is currently using the value assigned as the *Null* PZID for an existing packet zone, or is planning to use it in a future deployment, it must choose a different value. The *Null* PZID cannot be broadcast in an overhead message. If it is, then the current problem will continue in that network.

A deployed base station in a network that does not move the A10 link during handoff will include the *Null* PZID in a handoff message and in an ITSPM. If it does not, then neither

[4] A packet zone identifier's value can range from 1 to 255. Generally, networks number packet zones incrementally, beginning with the value 1. For this reason, low numbers were avoided. There are instances where the highest assignable number is used for special purposes, and for this reason, 255 was also avoided.

deployed nor updated mobile stations will be able to determine that a mobility origination is required following call release. The current problem will continue in that network.

A deployed base station in a network that moves the A10 link during handoff does not need to change its operation at all. It is not necessary to include the *Null* PZID in a handoff message or in an ITSPM.

A deployed mobile station may receive a handoff message or an ITSPM containing the *Null* PZID and store it as part of the mobile station's internal location information. Following call release, the mobile station will compare its stored location information to that being broadcast. Since the *Null* PZID will not be broadcast in any overhead message, the mobile station's stored location information will not match the packet zone identifier being broadcast, and the mobile station will perform a mobility origination. So even though the mobile stores the *Null* PZID, it will correctly perform a mobility origination and trigger A10 link relocation.

If a deployed mobile station stores the *Null* PZID in its packet zone list, the *Null* PZID will be included if the packet zone list is retrieved by a base station.