View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Technical Disclosure Common

Technical Disclosure Commons

Defensive Publications Series

March 2020

Packet Service Attach Procedure in Legacy Wireless Networks

Jean-Philippe Cormier

Florina Prisecaru

Follow this and additional works at: https://www.tdcommons.org/dpubs_series

Recommended Citation

Cormier, Jean-Philippe and Prisecaru, Florina, "Packet Service Attach Procedure in Legacy Wireless Networks", Technical Disclosure Commons, (March 30, 2020)
https://www.tdcommons.org/dpubs_series/3074

This work is licensed under a Creative Commons Attribution 4.0 License.

This Article is brought to you for free and open access by Technical Disclosure Commons. It has been accepted for inclusion in Defensive Publications Series by an authorized administrator of Technical Disclosure Commons.

PACKET SERVICE ATTACH PROCEDURE IN LEGACY WIRELESS NETWORKS

Abstract

Data services with legacy networks, or other cells that provide low data throughput, are disabled to accelerate reselection of a user equipment to cells that support higher bandwidths. The impaired cells are identified using techniques including determining whether SI2Quarter messaging is supported and comparing measured data throughput to the cell with a size of a transmission buffer in the user equipment.

Background

Wireless communication systems include a network of cells (also referred to as base stations) that provide wireless connectivity to user equipment within the network. Mobile user equipment hand over between different cells as the mobile user equipment moves through the network. For example, the user equipment monitors received signal strengths from neighboring cells and hands off from a source cell to a destination cell based on the relative received signal strengths from the source and destination cells. The radio access technologies used by the cells in the network typically include a mix of technologies that include Second Generation (2G) cells, Third Generation (3G) cells, Fourth Generation (4G)/Long Term Evolution (LTE) cells, and increasingly large numbers of Fifth Generation (5G) cells.

Heterogeneous networks cause problems for later generation user equipment when they move through regions that include cells that operate according to earlier generations of radio access technologies. For example, many applications implemented on user equipment that operate according to current generations (e.g., LTE or 5G) have bandwidth that exceed the data bandwidth provided by earlier generation radio access technology such as 2G and 3G. For example, if a smartphone is in an active state and attached to a legacy network while an application is transmitting data, there is really nothing the user can do to change the network if the transmission buffer is not empty and the device remains in the active state. Consequently, the user receives a poor quality of experience for data services provided by applications on the smart phone.

The aforementioned problems with legacy networks are expected to get worse because operators are re-farming the resources from legacy networks and only leaving the minimum required spectrum available to user equipment, which isn't enough spectrum to allow for useful voice + data communication. When the operators reduce the available physical resources on the legacy networks, they bias the legacy networks towards voice or circuit switched (CS) services. For example, in a 2G legacy network, fewer timeslots are allocated to data traffic and, in 3G legacy networks, fewer Walsh codes are allocated to the data domain to benefit voice services. Signaling Connection Release indication (SCRI) or fast dormancy can allow for a quick return to IDLE reselection. However, the reselection message won't be sent if the application has active data ongoing, *e.g.*, the transmission buffer is not empty. The transmission buffers need to be empty in order to trigger the signaling for SCRI or fast dormancy.

Description

Reselection of a user equipment from a legacy network to cells that implement more recent generations of radio access technologies that support higher bandwidths is accelerated by identifying "impaired" cells and disabling data services with the impaired cells. As used herein, the term "impaired" refers to a cell that operates according to a radio access technology that does not provide sufficient bandwidth or throughput to support data services provided by the user equipment. FIG. 1 illustrates a user equipment that is attached to a 2G cell (base station) and is unable to reselect to an LTE cell (base station) until the transmission buffer in the user equipment is empty.

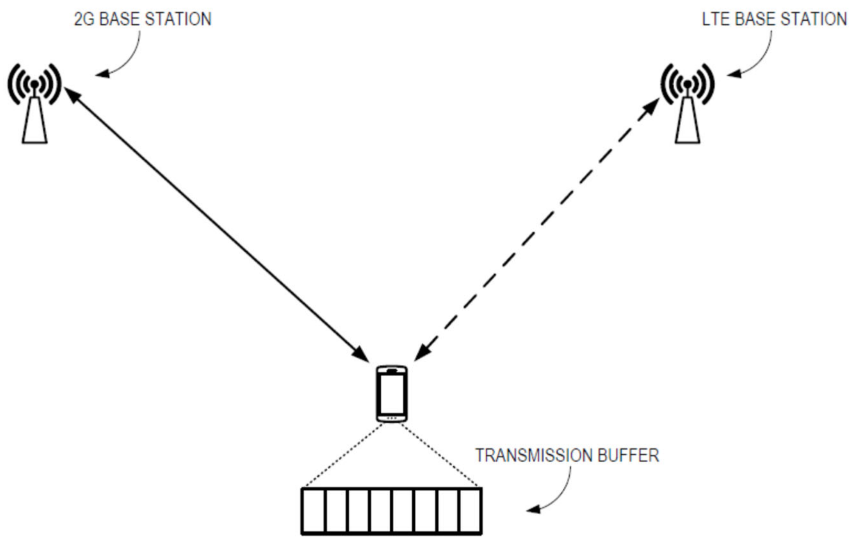

FIG. 1

A 2G cell is identified as an impaired cell in response to determining that the cell is not configured to support system information messages that provide neighbor cell related information to 4G cells, such as information associated with dual transfer mode (DTM) measurements. In that case, the user equipment declares that the combination of radio access technology and public land mobile network (PLMN) is impaired for data services. The user equipment then detaches from the packet-switched (PS) domain and modifies its configuration so that the user equipment no longer attaches to the PS domain on this radio access technology until the next reboot of the user equipment or until the user equipment enters/exits airplane mode.

In the rare cases that the user equipment reselects to an impaired 2G cell, the user equipment remains able to support calls and short message service (SMS) messages, but the user equipment will no longer support or have access to data services. Removing the data services accelerates (e.g., reduces the time until) the reselection to LTE because the reselection is not be impeded by having data to transmit. When the user equipment moves back to a radio access technology supporting fast data (LTE), the user equipment reconfigures itself to perform CS+PS attach so that the user equipment operates as normal. The signaling cost of disabling data services to accelerate reselection from the 2G network to an LTE network is minimal because of the low likelihood of moving from LTE to 2G.

A user equipment identifies a 3G cell as an impaired cell by monitoring the scheduling allocated by the network and estimating the physical layer throughput for a predetermined amount of time such as a predetermined number of milliseconds (ms). The user equipment compares the physical layer throughput to the size of the transmission buffer to estimate the time required to transmit the contents of the transmission buffer to the cell. If the time is greater than a threshold, the 3G cell is identified as an impaired cell for data.

In response to declaring the 3G cell as an impaired cell, fast dormancy signaling is sent to the network, which causes the user equipment to move from an active state to an IDLE state allowing for a fast reselection measurement for LTE. In this case, the user equipment measures the last known good frequency for the LTE connection and recovers the data connection after a tracking area update. The signaling load in the scenario is minimal to the network because the security context for the user equipment is retained from the previous attachment to the 3G cell.

The user equipment could collect a list of the impaired networks/cells and report them back to the network or a cloud-based service so that other user equipment (or other devices) can download a database including the list of impaired networks/cells. The list can be country-based or region-based to provide an idea of how the devices should be configured in different markets. Additionally, operators that do not want devices to use the data resources on certain parts of their networks could help pre-populate the database with a list of impaired networks/cells to indicate the networks, Radio Access Technology/Routing(Tracking) Area Codes, or Cell identifiers that are impaired.