Data Continuity During an Ongoing Priority Data Call Activity

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DATA CONTINUITY DURING AN ONGOING PRIORITY DATA CALL ACTIVITY

Abstract

Historically, voice calls were handled using circuit-switched sessions and data transfer was conventionally handled using packet-switched communication. However, increases in the speed and bandwidth of wireless communication systems have enabled packet-based applications to provide voice, video, and emergency calls. Interruptions in the packet-switched data transmission for voice, video, and emergency calls supported by protocols such as voice-over-Internet protocol (VoIP) are reduced or eliminated by differentiating between data calls and other data operations. Activities that cause data disruption during the data calls are then avoided or bypassed for these calls.

Background

Wireless communication systems provide wireless connectivity to user equipment via base stations that operate according to different radio access technologies (RATs). The communication sessions established by the user equipment can be packet-switched (PS) or circuit-switched (CS). In CS communication, the user equipment establishes a dedicated communication channel (circuit) through the network to another node in the network before the user equipment and the node are allowed to communicate. The circuit guarantees the full bandwidth of the channel is reserved for the CS session between the user equipment and the node. The user equipment and the node remain connected for the duration of the CS communication session. In contrast, PS communication between nodes in a network is performed by grouping data into packets that are independently transmitted through the network to the destination node. The packets include a header and a payload. Data in the header is used by networking hardware to direct the packet to its destination where the payload is extracted and
used by applications. Long term evolution (LTE) and New Radio Fifth Generation (NR5G) are examples of wireless data communication technologies (or RATs) that are based on PS technology.

Voice calls were conventionally handled using CS sessions and data transfer was conventionally handled using PS communication. However, deployment of LTE and NR5G protocols has increased the capacity and speed of wireless data networks and blurred the lines between CS communication and PS communication. For example, many data transfer and Internet protocol (IP) packet switching cellular networks now operate according to standards including LTE and NR5G, which has paved way to the introduction of a large number of applications (APP) that use the high speed data transmission protocols for high bandwidth applications including communication, presentations, meetings, conferences, social media, and the like.

In order to prevent undesirable effects on user experience during voice, video, or emergency calls supported by PS RATs such as LTE and 5G, a modem (or core processor, CP) in a user equipment uses IP multimedia subsystem (IMS) protocols for voice, video, and emergency calls on LTE and NR5G. For example, the modem can communicate via an IMS network using voice-over-LTE (VOLTE) or voice-over-New-Radio (VONR). Whenever VOLTE calls are started, the modem in the user equipment sets a certain priority state that prevents changes to the RAT, DETACH operations to detach the user equipment from the connection, and other activities that may interrupt the VOLTE/VONR calls over IMS. The priority state is not conventionally applied to PS data calls because CS connections were expected to be used for voice calls and PS communication was only used for Internet browsing.

In the current PS dominated era, data applications are used for day to day activities, and there is a need to differentiate between the data browsing activities and data priority applications that are used for voice calls, video calls, conference calls, meetings, etc. For example, voice-over-IP (VOIP) based third-party applications such as Google Hangouts, Whatsapp Call, Facebook Messenger services, and the like use VOIP architecture for voice and video calls. The CP/modem in the user equipment treats VOIP calls as regular internet data and no priority state is maintained within the modem for the VOIP call. Consequently, the user equipment may disconnect an ongoing data connection in various protocol specific situations. For example, the modem may detach a PS data connection in response to a preference change triggered by a carrier specific rule, power consumption algorithms, preferred service selection, and the like. In some of these cases a new data call is originated immediately thereafter on another network or RAT, but this leads to a change of IP address. Depending on the delay, the changing IP address can cause timeout of the activity in application, which results in a bad user experience.
Description

Interruptions in data calls, such as VOIP calls, are reduced or eliminated by differentiating the data calls from other data operations and avoiding activities that cause data disruption during the data calls.

FIG. 1 below illustrates the interactions between an application process and a modem processor or core processor (CP) such as exchanging indications of priority data call activities.

The application processor uses available resources to identify whether there is an ongoing third-party voice or video call using a third-party application. One example of a technique for identifying voice or video calls is whitelisting the application that provides the voice or video call. Another example of a technique for identifying voice and video calls provided by an application is correlating events associated with the application with peripherals that are being used by the application such as a vocoder, a microphone, a speaker, and the like.
In response to the application processor sending a request to the modem for the data transfer, the application processor calls an API to indicate priority data call activity.

Fig 2 below is a flow diagram of a method used to indicate high priority data call activity.

![Flow Diagram]

The modem uses the priority indication to maintain a state for the priority data call activity and continue with the data transfer. If there is any new activity received or triggered by
the modem to disable the PS RAT during the data call activity, then the modem buffers the PS RAT disabling activity until the data transfer is completed. Fig 3 below is a flow diagram of a method of buffering the PS RAT disabling activity during an active priority data call.

Once the third-party voice or video call is ended, the application processor provides an indication to the modem that the priority call activity has ended. In response to receiving the indication, the modem proceeds with the PS RAT disability request.
Fig 4 is a flow diagram of a method of disabling the priority data activity when the VOIP application is ended.

The techniques discussed herein have a number of advantages over conventional practice. Whenever a user is in an important conference call or hangout call over cellular or some important calls using the third-party VOIP applications, the call is not interrupted when the PS RAT disabling activity is triggered. Users are able to have the same priority for the VOLTE/VONR calls and for the third-party voice and video calls when the user equipment is
currently in LTE or NR5G service. Furthermore, the same design is applicable for all the PS RATs which will be evolved from NR5G.

User equipment that implement the techniques discussed herein operate in a different manner than conventional user equipment. As discussed herein, whenever there is third-party voice or video call activity involving the user equipment and if LTE or NR5G is disabled during the ongoing call, the call is not terminated and the mode preference is not changed. Once the call is ended, the user equipment should be able to change the mode preference as requested by the user. Whenever there is third-party voice or video call activity and if there is any thermal emergency related activity triggered that requires disabling data services, then all the data activity except for the ongoing call will be ended. Once the call is ended, the user equipment terminates the data activities including any further third-party voice and video calls. If there is third-party voice or video call activity involving the user equipment and if the operator requests that the user equipment change RATs (e.g., such as using the EF RAT change request supported by AT&T), the call will not be interrupted. Once the call is ended, the user equipment processes the operator’s request to change the EF RAT.