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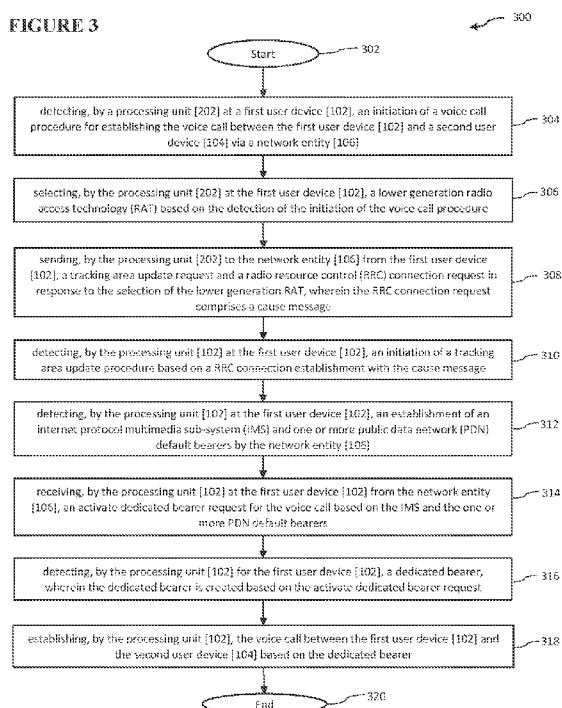
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(54) Title: METHOD AND SYSTEM FOR ESTABLISHING VOICE CALL

FIGURE 3



(57) Abstract: The present disclosure relates to a method and a system for establishing a voice call. The method comprises: detecting initiation of a voice call procedure for establishing the voice call between a first user device [102] and a second user device [104]; selecting a lower generation radio access technology based on the initiation of voice call procedure; sending tracking area update (TAU) request and radio resource control (RRC) connection request, wherein the RRC connection request comprises a cause message; detecting initiation of a TAU procedure based on a RRC connection establishment with the cause message; detecting establishment of internet protocol multimedia sub-system (IMS) and public data network (PDN) default bearer(s); receiving activate dedicated bearer request for voice call based on the IMS and PDN default bearer(s); detecting a dedicated bearer; and establishing the voice call based on the dedicated bearer.

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METHOD AND SYSTEM FOR ESTABLISHING VOICE CALL

TECHNICAL FIELD:

The present invention generally relates to voice calls in fifth generation (5G) mobile communication networks, and more particularly to methods and systems for avoiding voice call failure and establishing voice calls on user devices in case of radio resource control (RRC) release with redirection (RWR) failure and/or 5QI=1 (i.e., 5G quality of service identifier = 1) packet data unit (PDU) modification failure.

BACKGROUND OF THE DISCLOSURE:

The following description of the related art is intended to provide background information pertaining to the field of the disclosure. This section may include certain aspects of the art that may be related to various features of the present disclosure. However, it should be appreciated that this section is used only to enhance the understanding of the reader with respect to the present disclosure, and not as admissions of the prior art.

In 5G network, there is an option for internet protocol multimedia sub-system (IMS) stack to work on voice over new radio (VoNR). Another way to establish voice calls is to fallback to 4G network, i.e., voice over long term evolution (VoLTE) by redirecting user equipment (UE) or user device (UD) to long term evolution (LTE), i.e., the 4G network, for voice calls, that is known as EPS Fallback (EPSFB). For this purpose, both options, that is, VoNR and EPSFB for making voice calls are provided by most of the network providers. EPSFB calls, that is, calls after falling back to the lower radio access technology (RAT) have to be well maintained from the network provider and UEs. When 5G network coverage in an area is weak, or in case the network or the user equipment does not support VoNR, falling back to lower generation RAT (for example, 4G or 3G) is the only option for setting up voice calls, that are initiated by the network for the UE to fallback to the lower generation RAT such as LTE via RWR command to proceed with the call setup. However, there is a possibility of RWR failure in case of EPSFB calls leading to call setup failure. Further, there is also a possibility of 5QI=1 packet data unit (PDU) modification command failure in case of VoNR calls. This may lead to voice call failure and a bad user experience.

Thus, there is an imperative need to develop a solution that can provide for the user equipment to setup the voice call in case of network failure for RRC release with redirection (RWR) or 5QI=1 (i.e., 5G quality of service identifier = 1) packet data unit (PDU)

modification failure. This will help the users to have a better experience with establishing voice calls when in weak 5G networks or when the user devices of the users do not support voice calling feature over the higher RAT network, and in reducing call failures. Further, this may also help in optimizing registration of the user device to the network and may also help
5 improve battery efficiency of the user device.

SUMMARY OF THE DISCLOSURE

This section is provided to introduce certain objects and aspects of the present invention in a simplified form that are further described below in the detailed description. This summary is not intended to identify the key features or the scope of the claimed subject matter.

10 A first object of the present disclosure is to provide a method and a system for establishing a voice call on a user device that overcomes the limitations of the existing approaches.

Another object of the present disclosure is to provide a method and a system for establishing a voice call on a user device that is able to setup the voice call in case of network failure for RRC release with redirection (RWR) or 5QI=1 (i.e., 5G quality of service identifier = 1)
15 packet data unit (PDU) modification failure.

Yet another object of the present disclosure is to provide a method and a system for establishing a voice call on a user device that helps at least in: 1) reducing voice call failures on the user device, 2) optimizing key performance indicators (KPI) of network by optimizing quicker registration of the user device to the network and 3) improving battery efficiency of
20 the user device.

In order to achieve at least one of the objectives as mentioned above, one aspect of the present invention may relate to a method for establishing a voice call. The method comprises detecting, by a processing unit at a first user device, an initiation of a voice call procedure for establishing the voice call between the first user device and a second user device via a
25 network entity. Further, the method comprises selecting, by the processing unit at the first user device, a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure. The method also encompasses sending, by the processing unit to the network entity from the first user device, a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the
30 lower generation RAT, wherein the RRC connection request comprises a cause message. The method further comprises detecting, by the processing unit at the first user device, an

initiation of a tracking area update procedure based on a RRC connection establishment with the cause message. Further, the method comprises detecting, by the processing unit at the first user device, an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity. The method further
5 encompasses receiving, by the processing unit at the first user device from the network entity, an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers. Further, the method comprises detecting, by the processing unit for the first user device, a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request. Finally, the method comprises establishing, by the
10 processing unit, the voice call between the first user device and the second user device based on the dedicated bearer.

Another aspect of the present invention relates to a system for establishing a voice call. The system comprises a processing unit. The processing unit is configured to detect at a first user device, an initiation of a voice call procedure for establishing the voice call between the first
15 user device and a second user device via a network entity. Further, the processing unit is configured to select at the first user device, a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure. Further, the processing unit is configured to send, from the first user device to the network entity, a tracking area update request and a radio resource control (RRC) connection request in
20 response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message. Further, the processing unit is configured to detect at the first user device, an initiation of a tracking area update procedure based on a RRC connection establishment with the cause message. The processing unit is further configured to detect at the first user device, an establishment of an internet protocol multimedia sub-system (IMS)
25 and one or more public data network (PDN) default bearers by the network entity. Further, the processing unit is configured to receive, at the first user device from the network entity, an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers. Further, the processing unit is configured to detect for the first user device a dedicated bearer, wherein the dedicated bearer is created based on the activate
30 dedicated bearer request. Further, the processing unit is configured to establish the voice call between the first user device and the second user device based on the dedicated bearer.

Yet another aspect of the present disclosure may relate to a first user device for establishing a

voice call. The first user device comprising a system. The system further comprises a processing unit. The processing unit is configured to detect at the first user device, an initiation of a voice call procedure for establishing a voice call between the first user device and a second user device via a network entity. Further, the processing unit is configured to

5 select at the first user device, a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure. Further, the processing unit is configured to send, from the first user device to the network entity, a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message.

10 Further, the processing unit is configured to detect at the first user device an initiation of a tracking area update procedure based on a RRC connection establishment with the cause message. The processing unit is further configured to detect at the first user device, an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity. Further, the processing unit is

15 configured to receive, at the first user device from the network entity, an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers. Further, the processing unit is configured to detect for the first user device a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request. Further, the processing unit is configured to establish the voice call between the first user

20 device and the second user device based on the dedicated bearer.

BRIEF DESCRIPTION OF DRAWINGS

The accompanying drawings, which are incorporated herein, and constitute a part of this disclosure, illustrate exemplary embodiments of the disclosed methods and systems in which like reference numerals refer to the same parts throughout the different drawings.

25 Components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Also, the embodiments shown in the figures are not to be construed as limiting the disclosure, but the possible variants of the method and system according to the disclosure are illustrated herein to highlight the advantages of the disclosure. Some drawings may indicate the components using block

30 diagrams and may not represent the internal circuitry of each component. It will be appreciated by those skilled in the art that disclosure of such drawings includes disclosure of electrical components, electronic components or circuitry commonly used to implement such components.

FIG.1 illustrates an exemplary block diagram depicting an exemplary network architecture diagram [100], in accordance with an embodiment of the present disclosure.

FIG.2 illustrates an exemplary block diagram of a system [200] for establishing a voice call between a first user device and a second user device, in accordance with an embodiment of
5 the present disclosure.

FIG.3 illustrates an exemplary method flow diagram [300], for establishing a voice call between a first user device and a second user device, in accordance with an embodiment of the present disclosure.

FIG. 4 illustrates a detailed exemplary flow chart of a method for establishing a voice call
10 between a first user device and a second user device, in accordance with exemplary embodiments of the present disclosure.

The foregoing shall be more apparent from the following more detailed description of the disclosure.

DESCRIPTION OF THE INVENTION

15 In the following description, for the purposes of explanation, various specific details are set forth in order to provide a thorough understanding of embodiments of the present disclosure. It will be apparent, however, that embodiments of the present disclosure may be practiced without these specific details. Several features described hereafter may each be used independently of one another or with any combination of other features. An individual feature
20 may not address any of the problems discussed above or might address only some of the problems discussed above.

The ensuing description provides exemplary embodiments only, and is not intended to limit the scope, applicability, or configuration of the disclosure. Rather, the ensuing description of the exemplary embodiments will provide those skilled in the art with an enabling description
25 for implementing an exemplary embodiment. It should be understood that various changes may be made in the function and arrangement of elements without departing from the spirit and scope of the disclosure as set forth.

Specific details are given in the following description to provide a thorough understanding of the embodiments. However, it will be understood by one of ordinary skill in the art that the

embodiments may be practiced without these specific details. For example, circuits, systems, processes, and other components may be shown as components in block diagram form in order not to obscure the embodiments in unnecessary detail.

Also, it is noted that individual embodiments may be described as a process which is depicted
5 as a flowchart, a flow diagram, a data flow diagram, a structure diagram, or a block diagram. Although a flowchart may describe the operations as a sequential process, many of the operations may be performed in parallel or concurrently. In addition, the order of the operations may be re-arranged. A process is terminated when its operations are completed but could have additional steps not included in a figure.

10 The word “exemplary” and/or “demonstrative” is used herein to mean serving as an example, instance, or illustration. For the avoidance of doubt, the subject matter disclosed herein is not limited by such examples. In addition, any aspect or design described herein as “exemplary” and/or “demonstrative” is not necessarily to be construed as preferred or advantageous over
15 other aspects or designs, nor is it meant to preclude equivalent exemplary structures and techniques known to those of ordinary skill in the art. Furthermore, to the extent that the terms “includes,” “has,” “contains,” and other similar words are used in either the detailed description or the claims, such terms are intended to be inclusive—in a manner similar to the term “comprising” as an open transition word—without precluding any additional or other elements.

20 As used herein, a “processing unit” or “processor” or “operating processor” includes one or more processors, wherein processor refers to any logic circuitry for processing instructions. A processor may be a general-purpose processor, a special purpose processor, a conventional processor, a digital signal processor, a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application
25 Specific Integrated Circuits, Field Programmable Gate Array circuits, any other type of integrated circuits, etc. The processor may perform signal coding data processing, input/output processing, and/or any other functionality that enables the working of the system according to the present disclosure. More specifically, the processor or processing unit is a hardware processor.

30 As used herein, “a user equipment”, “a user device”, “a smart-user-device”, “a smart-device”, “an electronic device”, “a mobile device”, “a handheld device”, “a wireless communication

device”, “a mobile communication device”, “a communication device”, “a first user device” and “a second user device” may be any electrical, electronic and/or computing device or equipment, capable of implementing the features of the present disclosure. The user equipment/device may include, but is not limited to, a mobile phone, smart phone, laptop, a
5 general-purpose computer, desktop, personal digital assistant, tablet computer, wearable device or any other computing device which is capable of implementing the features of the present disclosure. Also, the user device may contain at least one input means configured to receive an input from at least one of a transceiver unit, a processing unit, a storage unit and any other such unit(s) which are required to implement the features of the present disclosure.

10 Currently, when the user devices are registered with the 5G network for 5G data services, for mobile originating (MO) and/or mobile terminating (MT) calls, the internet protocol multimedia sub-system (IMS) session initiation protocol (SIP) signaling starts in 5G without a dedicated bearer. After 183 session progress, there are two ways to establish a voice call:

1. In evolved packet system (EPS) FallBack method, a network sends RWR command to
15 a user device to fallback to a lower radio access technology (RAT) network (say, 3G or 4G, if 5G is the higher RAT) and establish the dedicated bearer in that lower RAT to establish the voice call with Real-time Transport Protocol (RTP) packet flow.
2. In voice over new radio (VoNR) method, the network sends 5QI=1 (i.e., 5G quality of service identifier = 1) packet data unit (PDU) modification with dedicated bearer
20 setup to proceed the session initiation protocol (SIP) signalling to establish the voice call and successful Real-time Transport Protocol (RTP) flow.

However, there are issues related to RWR failure and/or 5QI=1 PDU modification failure, delays due to configuration, Xn handover, network failure in 5G and weak 5G coverage, etc. For example, when there is a delay of more than 6 seconds, the call setup may fail in case the
25 telecom application server (TAS) in IMS structure has 6 seconds of timeout as per request for comments (RFC) specification. For example, according to RFC 3261 specification, when there is a delay of more than 6 seconds, the call setup will fail as the TAS in IMS structure has 6 seconds of timeout as per RFC specification with retries of consecutive 2 seconds each in case of Non-Invite SIP signaling messages and 14 seconds of timeout in case of Invite SIP
30 message with 3 retries of 2 seconds followed by next 4 seconds and then followed by another 8 seconds. In case of 5G network failure or 5G poor coverage, there could be call setup failure and there may be a need for the user device to switch to 4G or 3G and restrict the user

device for 5G data services. In such case, there may be higher call setup failure leading to poor user experience and network key performance indicator (KPI) degradation.

The present disclosure relates to a system and a method for establishing a voice call between a first user device and a second user device. The present invention provides a method and a system that enables a user equipment (UE) (i.e., the first user device) to switch to a lower RAT say LTE coverage by reselection mechanism using an internal defined timer of the UE, in case the UE fails to receive the RWR command (in case of EPSFB method) or 5QI=1 PDU modification command (in case of VoNR method) within a pre-defined time period. For the purposes of this disclosure, a person skilled in the art would understand the term “PDU modification” as the PDU modification for 5 QI = 1, and the term “PDU modification bearer” as the PDU modification bearer for 5 QI = 1, as generally used in the art, however the disclosure is not limited to a particular communication network and related terminologies and may be implemented in a manner as obvious to a person skilled in the art for other communication networks. The UE already has the reselection RAT with Band information from system information block Type 5 (SIB5) which the UE stores internally. After reselection to the lower RAT, the UE initiates a Tracking Area Update (TAU) Request along with radio resource control (RRC) connection request with a ‘cause – no voice call/mt access’. RRC connection setup with ‘cause – no voice call/mt access’ leads the network to create a dedicated bearer (e.g., QCI 1) for the UE. With this, the voice call establishment procedure along with real-time transport protocol (RTP) and real-time transport control protocol (RTCP) packet flow happens without delay.

Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings so that those skilled in the art can easily carry out the present disclosure.

Referring to Figure 1, the Figure 1 illustrates an exemplary block diagram depicting an exemplary network architecture diagram [100], in accordance with exemplary embodiments of the present disclosure. As shown in Figure 1, the exemplary network architecture diagram [100] comprises at least one first user device [102] connected to at least one second user device [104] via at least one network/network entity [106], wherein in an implementation, a system [200] resides in the first user device [102] and communicate with the network [106] via a communication means [204].

Also, in Figure 1 only single first user device (or may be referred to as user equipment) [102], single network [106], and single second user device [104] are shown, however, there may be multiple such first user devices [102], second user devices [104], and/or networks [106] or there may be any such numbers of said first user devices [102], second user devices [104] and/or networks [106] as obvious to a person skilled in the art or as required to implement the features of the present disclosure.

An exemplary overview of components of a system [200] for establishing a voice call between a first user device [102] and a second user device [102], in accordance with exemplary embodiments of the present invention, is shown in Figure 2. The system [200] comprises a processing unit [202], and a communication means [204], and all components of the system [200] assumed to be connected with each other until otherwise indicated in this disclosure.

Referring to Figure 2, the processing unit [202] detects an initiation of a voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106]. The voice call procedure is for handling call failure, that is, for avoiding call failure. This voice call procedure may be implemented particularly for avoiding call failure in case of network failure for RRC release with redirection (RWR) or 5QI=1 (i.e., 5G quality of service identifier = 1) packet data unit (PDU) modification failure.

In an implementation, prior to the detecting the initiation of the voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106], the processing unit [202] initiates an invite message for the voice call. For example, for initiating the invite message for mobile originating (MO)/mobile terminating (MT) voice call, user equipment (UE) initiates INVITE message with private – access network information (P-ANI) header as “3GPP-NR-FDD/TDD” and Session Description Protocol (SDP) content with enhanced voice services (EVS) audio codec. With this initiation, the network entity [106] sends a ‘183 session in progress’ message to the user equipment. In other words, the processing unit [202] receives, at the first user device [102] from the network entity [106], the session-in-progress message. This ‘183 session in progress’ message, as generally known in the art, provides headers and media that may be used to convey information about the voice call.

Further, the processing unit [202] initiates at the first user device [102] a counter-timer for a pre-defined time-period. The counter-timer is initiated for receiving one of a packet data unit (PDU) modification bearer and a RRC release with redirection (RWR) command within the pre-defined time-period. In a preferred implementation, this pre-defined time period is 3000 milliseconds (ms). In other implementations, the pre-defined time may be in the range of 2000 ms to 3500 ms. Also, in an implementation, the counter-timer is initiated on the IMS layer of the first user device [102].

Further, the processing unit [202] is configured to detect at the first user device [102], an indication of one of a successful receipt and an unsuccessful receipt of one of the packet data unit (PDU) modification bearer (e.g., 5QI=1/PDU modification bearer) and the RRC release with redirection (RWR) command within the pre-defined time-period. The receipt of the 5 QI =1/PDU Modification bearer is expected in case of VoNR and the receipt of the RRC release with redirection (RWR) is expected in case of EPSFB from the network. Here, in an event where the processing unit [202] detects: an indication of a successful receipt of one of the packet data unit (PDU) modification bearer, in case of the VoNR and an indication of a successful receipt of the RRC release with redirection (RWR) command, in case of the EPS fallback, within the pre-defined time-period, the voice call may be established between the first user device [102] and the second user device [104] via the network entity [106] by following the standard procedure. However, in an implementation, where the processing unit [202] detects an indication of an unsuccessful receipt of one of the packet data unit (PDU) modification bearer and the RRC release with redirection (RWR) command within the pre-defined time-period, the processing unit [202] initiates the voice call procedure based on the unsuccessful receipt. In an instance, the PDU modification bearer (e.g., the 5QI=1 / PDU modification bearer) or RWR may not be received by the first user device [102] due to network failure or any other cause. Also, the voice call procedure is the procedure to avoid voice call failure and establish the voice call even when the 5QI=1 / PDU modification bearer or RWR command has not been received by the first user device [102] within the pre-defined time period of, say for example, 3000 ms, after which the counter-timer expires.

Thus, after the expiry of the counter-timer upon non-receiving of the 5QI=1 / PDU modification bearer or the RWR command, the processing unit [202] detects the initiation of the voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106].

After detecting the initiation of the voice call procedure, the processing unit [202] selects at the first user device [102], a lower generation radio access technology (RAT). This lower generation RAT may be any previous generation of mobile communications as compared to the latest generation of the RAT through which the first user device [102] is connected to the network entity [106]. For example, the first user device [102] is connected to the network entity [106] through the 5G (i.e., fifth generation) network. Then, the lower generation RAT may be 4G, 3G, and 2G (i.e., fourth generation, third generation, and second generation of mobile communications as generally known in the art). Thus, in an implementation, where the first user device [102] is connected to a 5G network, the processing unit [202] at the first user device [102] may select a lower generation radio access technology (RAT), say, 4G.

Also, in an implementation, the processing unit [202], to select the lower generation RAT, is configured to send an indication to a radio resource control (RRC) layer for selecting the lower generation RAT. As generally known in the art, the RRC layer controls communications between a user device and a base station in the 4G network. The RRC layer is the highest layer in the control plane of the Access Stratum (AS). Further, the RRC layer also facilitates transfer of messages of the Non-Access Stratum (NAS) layer, which is located above the RRC layer. NAS messages are used to control communications between a user device and the Evolved Packet Core (EPC), that is a framework for providing voice and data on a 4G long-term evolution (LTE) network. Thus, the processing unit [202] further sends an indication to a non-access stratum (NAS) layer for selecting the lower generation RAT.

Further, the processing unit [202] sends, from the first user device [102] to the network entity [106], a tracking area update (TAU) request and a radio resource control (RRC) connection request in response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message. The tracking area update (TAU) request is sent by the first user device [102] to update the tracking area identity (TAI) on a serving cell as it detects a change to a new tracking area. Also, the RRC connection request, as generally known in the art, is sent for requesting the Evolved Universal Mobile Telecommunications Service (UMTS) Terrestrial Radio Access Network (E-UTRAN) for the establishment of an RRC connection.

Also, as mentioned earlier in this disclosure, the RRC connection request comprises the cause message. In an implementation, the cause message (i.e., RRC connection request cause message) comprises at least one of a cause – mobile originating voice call (cause – MO-voice

call) for the first user device [102] and a cause – mobile terminating access (cause – MT-access) for the second user device [104]. Here, if the cause of failure is at mobile originating (MO) side, that is at the side of the first user device [102], where the first user device [102] is making voice call to the second user device [104], then the cause – MO-voice call is sent with the RRC connection request. And, if the cause of failure is at mobile terminating (MT) side, that is at the side of the second user device [104], where the first user device [102] is making voice call to the second user device [104], then the cause – MT-access is sent with the RRC connection request. The cause – MO-voice call and the cause – MT-access are initiated for RRC connection establishment to send the tracking area update. Thus, the processing unit [202] detects at the first user device [102], an initiation of a tracking area update (TAU) procedure based on the RRC connection establishment with the cause message.

Further, the processing unit [202] detects at the first user device [102], an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity [106]. The IMS, as generally known in the art, is a standards-based architectural framework for delivering multimedia communications services such as voice, video and text messaging over internet protocol (IP) networks. IMS network may be a separate network from normal internet and may be associated with a separate own access point name (APN). Also, there may be a separate default bearer for the IMS network. Also, as generally known in the art, a PDN connectivity procedure is used by a user device to request the setup of a default evolved packet service bearer (EPS bearer) to a PDN. Here, the user device requests connectivity to a PDN by sending a PDN CONNECTIVITY REQUEST message to the network. If this request is accepted by the network, then it initiates the establishment of a default EPS bearer context activation procedure. This procedure is used to establish default bearers, here referred to as the PDN default bearers. Also, the TAU request is referred to as being successful with the IMS and PDN default bearers getting established.

Further, as the TAU procedure is for ‘MO-voice call’ or ‘MT-access’, the network entity [106] sends an ‘activate dedicated bearer request’ to the user device for the voice call. Thus, the processing unit [202] receives, at the first user device [102] from the network entity [106], the ‘activate dedicated bearer request’ for the voice call based on the IMS and the one or more PDN default bearers. The dedicated bearers provide dedicated tunnel to one or more specific traffic, such as, the voice call. A dedicated bearer acts as an additional bearer on top of the default bearer.

Further, the processing unit [202] detects for the first user device [102] a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request. Finally, the processing unit [202] establishes the voice call between the first user device [102] and the second user device [104] based on the dedicated bearer to start Real-Time Transport Control Protocol (RTCP)/ Real-Time Transport Protocol (RTP) flow. Pertinently, in the background of this process, the retry timer of the telecom application server (TAS) of 6 seconds with retry every 2 seconds for non-Invite SIP messages as per RFC standards 3261 is already running with which the dedicated bearer is established for setting up the voice call. Therefore, there is no extra time incurred for establishing the voice call using the procedure as disclosed above, and as a result, there is no violation of the RFC standards in setting up the voice call with the procedure explained above.

Now, referring to Figure 3, which illustrates an exemplary method flow diagram [300], for establishing a voice call between a first user device [102] and a second user device [104], in accordance with an embodiment of the present disclosure. The method starts at step 302 upon expiry of a counter-timer on non-receiving of a packet data unit (PDU) modification bearer (e.g., a 5QI=1 / PDU modification bearer) in case of VoNR or a RRC release with redirection (RWR) command in case of EPSFB from a network and goes to step 304. At step 304, the method comprises detecting, by the processing unit [202] at the first user device [102], an initiation of a voice call procedure for establishing the voice call between the first user device [102] and a second user device [104] via a network entity [106]. The voice call procedure is for handling call failure, that is, for avoiding call failure. This voice call procedure may be implemented particularly for avoiding call failure in case of network failure for RRC release with redirection (RWR) or 5QI=1 (i.e., 5G quality of service identifier = 1) packet data unit (PDU) modification failure.

In an implementation, prior to the detecting, by the processing unit [202] at the first user device [102], the initiation of the voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106], the processing unit [202] initiates an invite message for the voice call. For example, for initiating the invite message for mobile originating (MO)/mobile terminating (MT) voice call, user equipment (UE) initiates INVITE message with private – access network information (P-ANI) header as “3GPP-NR-FDD/TDD” and Session Description protocol (SDP) content with enhanced voice services (EVS) audio codec. With this initiation, the network entity [106]

sends a '183 session in progress' message to the user equipment. In other words, the processing unit [202] receives, at the first user device [102] from the network entity [106], the session-in-progress message. This '183 session in progress' message, as generally known in the art, provides headers and media that may be used to convey information about the voice call.

Further, the processing unit [202] initiates at the first user device [102] a counter-timer for a pre-defined time-period. The counter-timer is initiated for receiving one of a packet data unit (PDU) modification bearer and a RRC release with redirection (RWR) command within the pre-defined time-period. In a preferred implementation, this pre-defined time period is 3000 milliseconds (ms). In other implementations, the pre-defined time may be in the range of 2000----- ms to 3500----- ms. Also, in an implementation, the counter-timer is initiated on an IMS layer of the first user device [102].

Further, the processing unit [202] detects at the first user device [102] an indication of one of a successful receipt and an unsuccessful receipt of one of the packet data unit (PDU) modification bearer and the RRC release with redirection (RWR) command within the pre-defined time-period. The receipt of the PDU modification bearer (say a 5 QI =1/PDU modification bearer) is expected in case of VoNR and the receipt of the RRC release with redirection (RWR) is expected in case of EPSFB from the network. Here, in an event where the processing unit [202] detects: an indication of a successful receipt of one of the packet data unit (PDU) modification bearer, in case of the VoNR, and an indication of a successful receipt of the RRC release with redirection (RWR) command, in case of the EPS fallback, within the pre-defined time-period, the voice call may be established between the first user device [102] and the second user device [104] via the network entity [106] by following the standard procedure.

In an implementation, where the processing unit [202] detects an indication of an unsuccessful receipt of one of the packet data unit (PDU) modification bearer and the RRC release with redirection (RWR) command within the pre-defined time-period, the processing unit [202] initiates the voice call procedure based on the unsuccessful receipt. In an instance, the PDU modification bearer (e.g., the 5QI=1 / PDU modification bearer) or RWR may not be received by the first user device [102] due to network failure or any other cause. Also, the voice call procedure is the procedure to avoid voice call failure and establish the voice call even when the 5QI=1 / PDU modification bearer or RWR command has not been received by

the first user device [102] within the pre-defined time period of, say for example, 3000 ms, after which the counter-timer expires.

Thus, after the expiry of the counter-timer upon non-receiving of the 5QI=1 / PDU modification bearer or the RWR command, the processing unit [202] detects the initiation of the voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106] as shown in step 304 of Figure 3.

After detecting the initiation of the voice call procedure, at step 306, the method comprises selecting, by the processing unit [202] at the first user device [102], a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure. This lower generation RAT may be any previous generation of mobile communications as compared to the latest generation of the RAT through which the first user device [102] is connected to the network entity [106]. For example, the first user device [102] is connected to the network entity [106] through the 5G (i.e., fifth generation) network. Then, the lower generation RAT may be 4G, 3G, and 2G (i.e., fourth generation, third generation, and second generation of mobile communications as generally known in the art). Thus, in an implementation, where the first user device [102] is connected to a 5G network, the processing unit [202] at the first user device [102] may select a lower generation radio access technology (RAT), say, 4G.

Also, in an implementation, the processing unit [202], to select the lower generation RAT, sends an indication to a radio resource control (RRC) layer for selecting the lower generation RAT. As generally known in the art, the RRC layer controls communications between a user device and a base station in the 4G network. The RRC layer is the highest layer in the control plane of the Access Stratum (AS). Further, the RRC layer also facilitates transfer of messages of the Non-Access Stratum (NAS) layer, which is located above the RRC layer. NAS messages are used to control communications between a user device and the Evolved Packet Core (EPC), that is a framework for providing voice and data on a 4G long-term evolution (LTE) network. Thus, the processing unit [202] further sends an indication to a non-access stratum (NAS) layer for selecting the lower generation RAT.

Further, at step 308, the method comprises sending, by the processing unit [202] to the network entity [106] from the first user device [102], a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the lower

generation RAT, wherein the RRC connection request comprises a cause message. The tracking area update (TAU) request is sent by the first user device [102] to update the tracking area identity (TAI) on a serving cell as it detects a change to a new tracking area. Also, the RRC connection request, as generally known in the art, is sent for requesting the
5 Evolved Universal Mobile Telecommunications Service (UMTS) Terrestrial Radio Access Network (E-UTRAN) for the establishment of an RRC connection.

Also, as mentioned earlier in this disclosure, the RRC connection request comprises the cause message. In an implementation, the cause message (i.e., RRC connection request cause message) comprises at least one of a cause – mobile originating voice call (cause – MO-voice
10 call) for the first user device [102] and a cause – mobile terminating access (cause – MT-access) for the second user device [104]. Here, if the cause of failure is at mobile originating (MO) side, that is at the side of the first user device [102], where the first user device [102] is making voice call to the second user device [104], then the cause – MO-voice call is sent with the RRC connection request. And, if the cause of failure is at mobile terminating (MT) side,
15 that is at the side of the second user device [104], where the first user device [102] is making voice call to the second user device [104], then the cause – MT-access is sent with the RRC connection request. The cause – MO-voice call and the cause – MT-access are initiated for RRC connection establishment to send the tracking area update. Thus, at step 310, the method comprises detecting, by the processing unit [102] at the first user device [102], an
20 initiation of a tracking area update procedure based on the RRC connection establishment with the cause message.

Further, at step 312, the method comprises detecting, by the processing unit [102] at the first user device [102], an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity [106]. The
25 IMS, as generally known in the art is a standards-based architectural framework for delivering multimedia communications services such as voice, video and text messaging over internet protocol (IP) networks. IMS network may be a separate network from normal internet and may be associated with a separate own access point name (APN). Also, there may be a separate default bearer for the IMS network. Also, as generally known in the art, a
30 PDN connectivity procedure is used by a user device to request the setup of a default evolved packet service bearer (EPS bearer) to a PDN. Here, the user device requests connectivity to a PDN by sending a PDN CONNECTIVITY REQUEST message to the network. If this

request is accepted by the network, then it initiates the establishment of a default EPS bearer context activation procedure. This procedure is used to establish default bearers, here referred to as the PDN default bearers. Also, the TAU request is referred to as being successful with the IMS and PDN default bearers getting established.

5 Further, as the TAU procedure is for ‘MO-voice call’ or ‘MT-access’, the network entity [106] sends an ‘activate dedicated bearer request’ to the user device for the voice call. Thus, at step 314, the method comprises receiving, by the processing unit [102] at the first user device [102] from the network entity [106], the activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers. The dedicated bearers
10 provide dedicated tunnel to one or more specific traffic, such as, the voice call. A dedicated bearer acts as an additional bearer on top of the default bearer.

Further, at step 316, the method comprises detecting, by the processing unit [102] for the first user device [102], a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request. Finally, at step 318, the method comprises establishing, by
15 the processing unit [102], the voice call between the first user device [102] and the second user device [104] based on the dedicated bearer to start Real-Time Transport Control Protocol (RTCP)/ Real-Time Transport Protocol (RTP) flow, and the method terminates at step 320 upon establishment of the voice call. Pertinently, in the background of this process, the retry timer of the telecom application server (TAS) of 6 seconds with retry every 2
20 seconds for non-Invite SIP messages as per RFC standards 3261 is already running with which the dedicated bearer is established for setting up the voice call. Therefore, there is no extra time incurred for establishing the voice call using the procedure as disclosed above, and as a result, there is no violation of the RFC standards in setting up the voice call with the procedure explained above.

25 Now, referring to Figure 4, which illustrates a detailed exemplary flow chart of a method for establishing a voice call between a first user device [102] and a second user device [104], in accordance with exemplary embodiments of the present disclosure. It is pertinent to mention that the flowchart shown in Figure 4 is only exemplary and provided for understanding purposes, and the same does not limit or restrict the present disclosure in any possible
30 manner. In this exemplary case, say, the first user device [102] makes a voice call to the second user device [104] via the network entity [106]. As shown, at step 402, a user initiates a voice call while the first user device [102] is connected to the network entity [106] via 5G

network. At step 404, the mobile originating (MO) session initiation protocol (SIP) invite is sent by the first user device [102] to the network entity [106]. At step 406, the telecom application server (TAS) responds for the SIP invite sent. The TAS here receives the response for the MO SIP invite from the mobile terminating (MT) user device, i.e., the second user device [104] and then responds to the MO user device, i.e., the first user device [102]. Also, as shown at step 408, if the TAS does not respond to the SIP invite, a timer of 14 seconds with 3 retries of 2, 4, 8 seconds interval for SIP invite is started at the first user device [102]. This timer of 14 seconds is set as per the relevant request for comments (RFC) standards. If the TAS responds to the SIP invite to the first user device [102], then the '100 Trying' response procedure is initiated as shown at step 410. Further, if no '100 Trying' response is received by the first user device [102] at step 410, then a timer of 6 seconds with 3 retries of 2 seconds interval is started at the first user device [102] as per the RFC standards, as shown in step 412. If the '100 Trying' response is received by the first user device [102] at step 410, then an indication related to '183-session-in-progress' is received at the first user device [102] as shown in step 414. Further, in case the indication related to '183-session-in-progress' received at the first user device [102] at step 414, suggests that the '183-session-in-progress' has not started, then the timer of 6 seconds with 3 retries of 2 seconds interval is started at the first user device [102] as per the RFC standards, as shown in step 412. In case, the indication related to '183-session-in-progress' received at the first user device [102] at step 414, suggests that the '183-session-in-progress' has started, then a 3 second timer is triggered at the first user device IP Multimedia Subsystem (IMS) stack as shown at step 416. Further, at step 418, it is checked whether RWR command or 5QI=1 PDU Modification is received within 3 seconds by MO side and/or MT side. If the RWR command or 5QI=1 PDU Modification is received within 3 seconds, then the Call Setup completed with acknowledgement (ACK) received as shown in step 420, as per the currently existing procedure and the call is ended/ terminated as shown in step 436. Further, if the RWR command or 5QI=1 PDU Modification is not received within 3 seconds, then at step 422 the first user device [102] reselects the radio Access Technology (RAT), that is, a lower RAT such as 4G (or LTE). At step 424 and 426, tracking area unit (TAU) request with IMS and data bearers and a radio resource control (RRC) connection request is sent by the first user device [102], wherein the RRC connection request comprises a cause message. The cause message comprises at least one of a cause – mobile originating voice call (cause – MO-voice call) for the first user device [102] and a cause – mobile terminating access (cause – MT-access) for the second user device [104]. In an implementation, the step 424 and the step 426

occur simultaneously with or without a small time delay. If TAU request is accepted by the network entity [106] as shown in step 428, then it initiates the establishment of a default EPS bearer context activation procedure. This procedure is used to establish default bearers, here referred to as the PDN default bearers. Also, the TAU request is referred to as being
5 successful with the IMS and PDN default bearers getting established. Further, SIP signaling resumes as shown in step 430, and dedicated bearers are established as shown in step 432. Further, as shown in step 434, the call setup is completed with acknowledgement (ACK) received. Thus, the call establishment procedure is completed, and the call is ended/terminated as shown in step 436 i.e., call ended with IMS SIP BYE as 'User Disconnected'.

10 Moreover, an aspect of the present disclosure may relate to a first user device for establishing a voice call. The first user device comprising a system. The system further comprises a processing unit. The processing unit is configured to detect at the first user device, an initiation of a voice call procedure for establishing a voice call between the first user device and a second user device via a network entity. Further, the processing unit is configured to
15 select at the first user device, a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure. Further, the processing unit is configured to send, from the first user device to the network entity, a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message.
20 Further, the processing unit is configured to detect at the first user device an initiation of a tracking area update procedure based on the RRC connection establishment with the cause message. The processing unit is further configured to detect at the first user device, an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity. Further, the processing unit is
25 configured to receive, at the first user device from the network entity, an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers. Further, the processing unit is configured to detect for the first user device a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request. Further, the processing unit is configured to establish the voice call between the first user
30 device and the second user device based on the dedicated bearer to start RTCP/RTP flow.

Thus, the present invention provides a novel solution for establishing a voice call between a first user device and a second user device. The present invention provides a solution that is

technically advanced over the currently known solutions as it is able to setup voice call in case of network failure for RRC release with redirection (RWR) or 5QI=1 (i.e., 5G quality of service identifier = 1) packet data unit (PDU) modification failure. Further, implementing the features as explained in the present disclosure, a person skilled in the art would be able to

5 reducing voice call failures on user devices thereby improving the key performance indicators (KPI) of the network provider, and optimize quicker registration of the user device to the network. The implementation of features of the present invention also improves battery efficiency of the user devices. Further, implementing the features as disclosed above, one would be able to obtain a mechanism to sustain a call even in case of network failure on

10 higher RAT by giving control to the user device to reselect a lower RAT.

While considerable emphasis has been placed herein on the preferred embodiments, it will be appreciated that many embodiments can be made and that many changes can be made in the preferred embodiments without departing from the principles of the invention. These and other changes in the preferred embodiments of the invention will be apparent to those skilled

15 in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter to be implemented merely as illustrative of the invention and not as limitation.

We Claim:

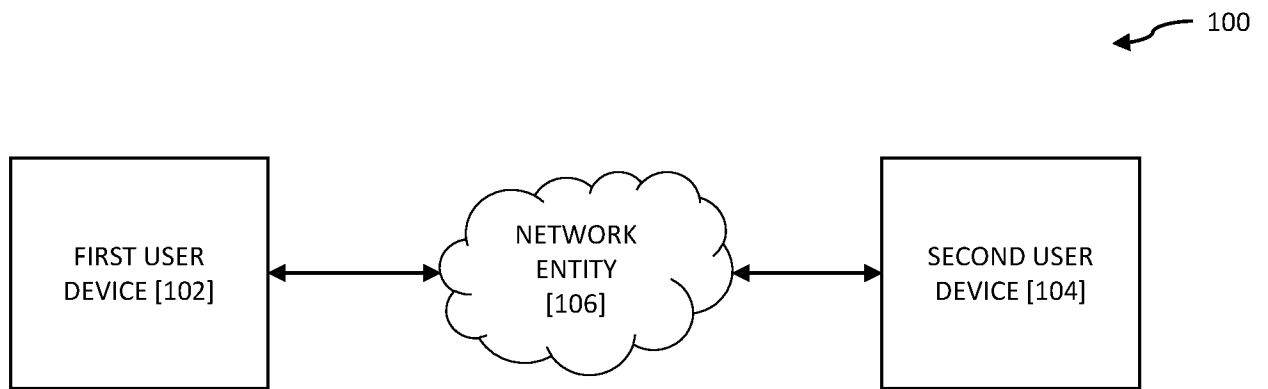
1. A method for establishing a voice call, the method comprising:
 - detecting, by a processing unit [202] at a first user device [102], an initiation of a voice call procedure for establishing the voice call between the first user device [102] and a second user device [104] via a network entity [106];
 - selecting, by the processing unit [202] at the first user device [102], a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure;
 - sending, by the processing unit [202] to the network entity [106] from the first user device [102], a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message;
 - detecting, by the processing unit [102] at the first user device [102], an initiation of a tracking area update procedure based on a RRC connection establishment with the cause message;
 - detecting, by the processing unit [102] at the first user device [102], an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity [106];
 - receiving, by the processing unit [102] at the first user device [102] from the network entity [106], an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers;
 - detecting, by the processing unit [102] for the first user device [102], a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request; and
 - establishing, by the processing unit [102], the voice call between the first user device [102] and the second user device [104] based on the dedicated bearer.
2. The method as claimed in claim 1, wherein the cause message comprises at least one of a cause – mobile originating -voice call (cause – MO-voice call) for the first user device [102] and a cause – mobile terminating-access (cause – MT-access) for the second user device [104].

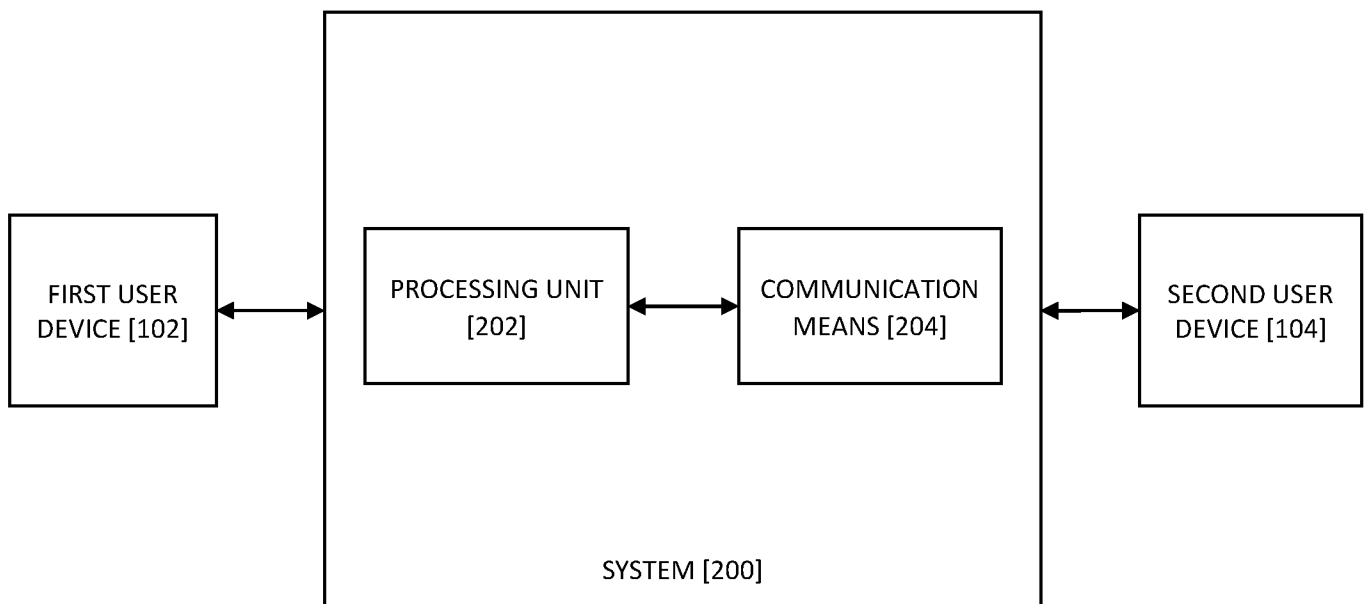
3. The method as claimed in claim 1, wherein the selecting, by the processing unit [202] at the first user device [102], the lower generation RAT further comprises:
 - sending, by the processing unit [202], an indication to a RRC layer for selecting the lower generation RAT; and
 - sending, by the processing unit [202], an indication to a non-access stratum (NAS) layer for selecting the lower generation RAT.
4. The method as claimed in claim 1, wherein prior to the detecting, by the processing unit [202] at the first user device [102], the initiation of the voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106], the method comprises:
 - initiating, by the processing unit [202] at the first user device [102], an invite message for the voice call;
 - receiving, by the processing unit [202] at the first user device [102] from the network entity [106], a session-in-progress message;
 - initiating, by the processing unit [202] at the first user device [102], a counter-timer for a pre-defined time-period, wherein the counter-timer is initiated for receiving one of a packet data unit (PDU) modification bearer and a RRC release with redirection (RWR) command within the pre-defined time-period;
 - detecting, by the processing unit [202] at the first user device [102], an indication of an unsuccessful receipt of the one of the packet data unit (PDU) modification bearer and the RRC release with redirection (RWR) command within the pre-defined time-period; and
 - initiating, by the processing unit [202] at the first user device [102], the voice call procedure based on the unsuccessful receipt.
5. The method as claimed in claim 4, wherein the pre-defined time-period is in a range of 2000 – 3500 milliseconds.
6. The method as claimed in claim 4, wherein the counter-timer is initiated on an IMS layer of the first user device [102].
7. A system for establishing a voice call, the system comprising:

- a processing unit [202] configured to:
 - o detect, at a first user device [102], an initiation of a voice call procedure for establishing the voice call between the first user device [102] and a second user device [104] via a network entity [106];
 - o select, at the first user device [102], a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure;
 - o send, from the first user device [102] to the network entity [106], a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message;
 - o detect, at the first user device [102], an initiation of a tracking area update procedure based on a RRC connection establishment with the cause message;
 - o detect, at the first user device [102], an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity [106];
 - o receive, at the first user device [102] from the network entity [106], an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers;
 - o detect, for the first user device [102], a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request; and
 - o establish the voice call between the first user device [102] and the second user device [104] based on the dedicated bearer.
- 8. The system as claimed in claim 7, wherein the cause message comprises at least one of a cause – mobile originating voice call (cause – MO-voice call) for the first user device [102] and a cause – mobile terminating access (cause – MT-access) for the second user device [104].
- 9. The system as claimed in claim 7, wherein the processing unit [202], to select the lower generation RAT, is further configured to:

- send an indication to a RRC layer for selecting the lower generation RAT; and
 - send an indication to a non-access stratum (NAS) layer for selecting the lower generation RAT.
10. The system as claimed in claim 7, wherein prior to the detection of the initiation of the voice call procedure for establishing the voice call between the first user device [102] and the second user device [104] via the network entity [106], the processing unit [202] is configured to:
- initiate, at the first user device [102], an invite message for the voice call;
 - receive, at the first user device [102] from the network entity [106], a session-in-progress message;
 - initiate, at the first user device [102], a counter-timer for a pre-defined time-period, wherein the counter-timer is initiated for receiving one of a packet data unit (PDU) modification bearer and a RRC release with redirection (RWR) command within the pre-defined time-period;
 - detect, at the first user device [102], an indication of an unsuccessful receipt of the one of the packet data unit (PDU) modification bearer and the RRC release with redirection (RWR) command within the pre-defined time-period; and
 - initiate, at the first user device [102], the voice call procedure based on the unsuccessful receipt.
11. The system as claimed in claim 10, wherein the pre-defined time-period is in a range of 2000 – 3500 milliseconds.
12. The system as claimed in claim 10, wherein the counter-timer is initiated on an IMS layer of the first user device [102].
13. A first user device for establishing a voice call, the first user device comprising:
- a system, wherein the system comprises a processing unit [202] configured to:
 - o detect, at the first user device [102], an initiation of a voice call procedure for establishing the voice call between the first user device [102] and a second user device [104] via a network entity [106];

- select, at the first user device [102], a lower generation radio access technology (RAT) based on the detection of the initiation of the voice call procedure;
- send, from the first user device [102], to the network entity [106], a tracking area update request and a radio resource control (RRC) connection request in response to the selection of the lower generation RAT, wherein the RRC connection request comprises a cause message;
- detect, at the first user device [102], an initiation of a tracking area update procedure based on a RRC connection establishment with the cause message;
- detect, at the first user device [102], an establishment of an internet protocol multimedia sub-system (IMS) and one or more public data network (PDN) default bearers by the network entity [106];
- receive, at the first user device [102] from the network entity [106], an activate dedicated bearer request for the voice call based on the IMS and the one or more PDN default bearers;
- detect, for the first user device [102], a dedicated bearer, wherein the dedicated bearer is created based on the activate dedicated bearer request; and
- establish the voice call between the first user device [102] and the second user device [104] based on the dedicated bearer.

**FIGURE 1**

**FIGURE 2**

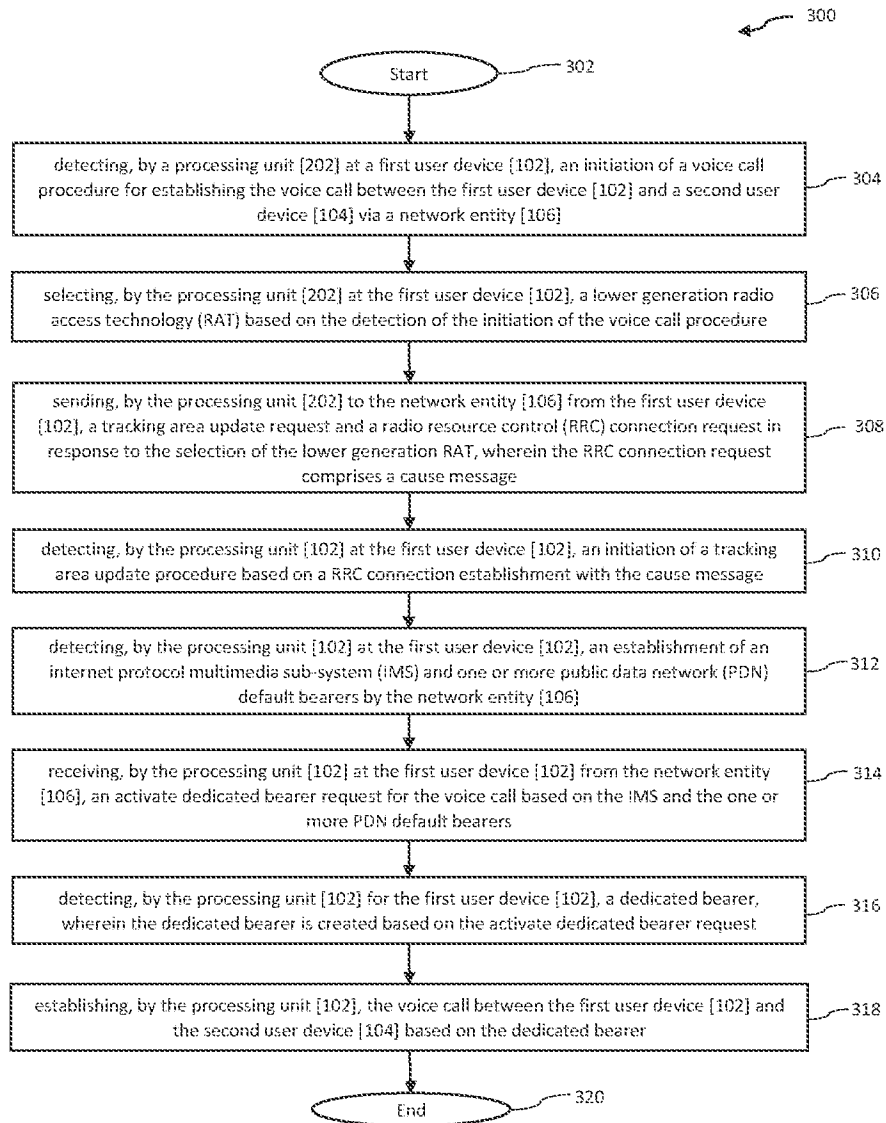


FIGURE 3

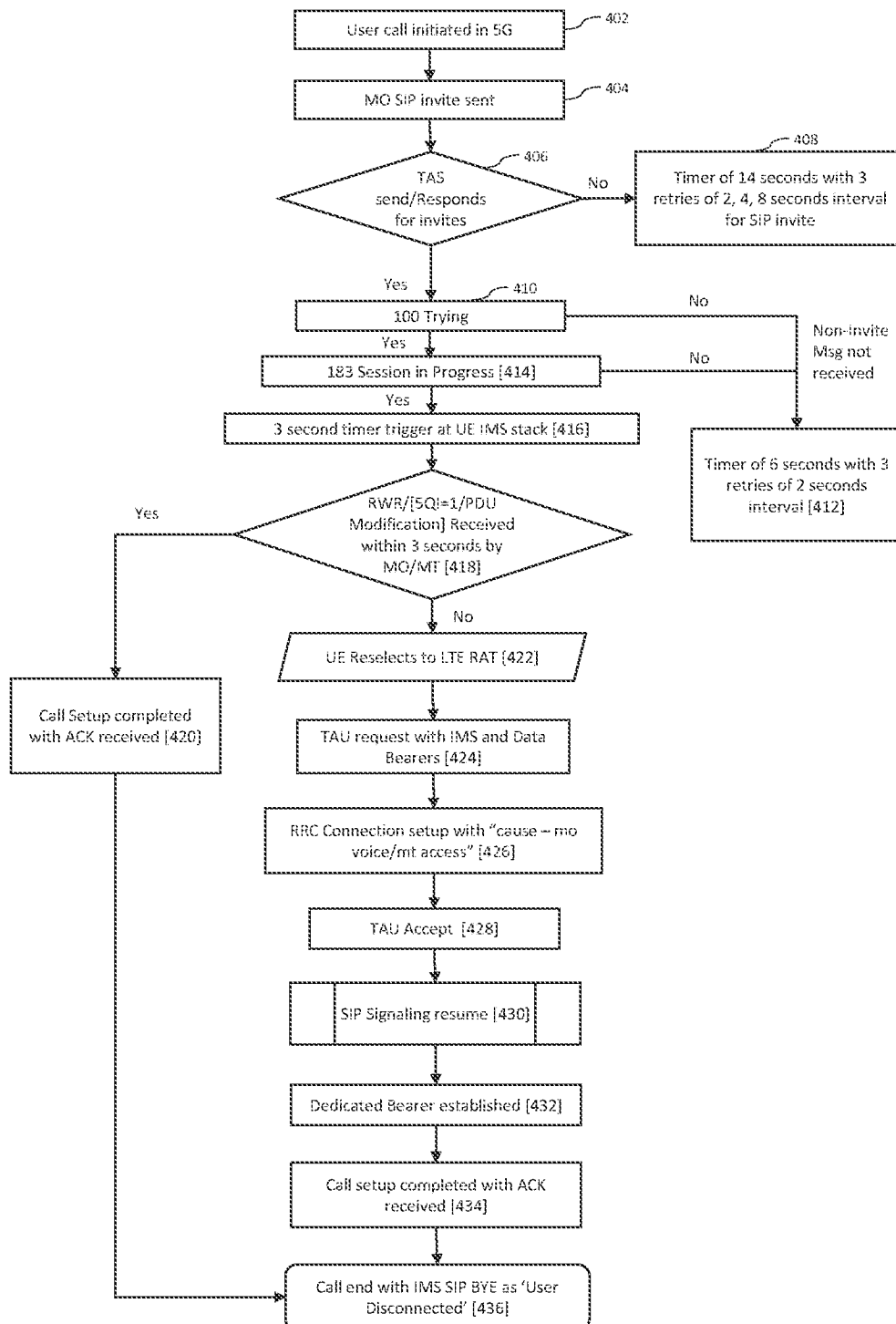


FIGURE 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2024/055130

A. CLASSIFICATION OF SUBJECT MATTER

H04L65/80, H04L65/1016, H04L65/1069, H04W76/10, H04W28/00 Version=2024.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP3772864A1 (SAMSUNG ELECTRONICS CO LTD) 10 Feb 2021 (10-02-2021) paragraphs [0030], [0050], [0052], [0059]-[0060], [0067], [0069]	1, 3, 7, 9, 13
Y	paragraphs [0030], [0050], [0052], [0059]-[0060], [0067], [0069]	2, 4-6, 8, 10-12
Y	US20090036130A1 (TELEFONAKTIEBOLAGET LM ERICSSON AB) 05 Feb 2009 (05-02-2009) paragraph [0020]-[0021]	2, 4-6, 8, 10-12



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2024/055130

Citation	Pub.Date	Family	Pub.Date
EP 3772864 A1	10-02-2021	US 11606730 B2	14-03-2023
		US 12004022 B2	04-06-2024
		WO 2021025463 A1	11-02-2021
		IN 202237005380 A	06-05-2022
		CN 114208281 A	18-03-2022
US 20090036130 A1	05-02-2009	US 9277460 B2	01-03-2016
		EP 2156682 A1	24-02-2010
		WO 2008155314 A1	24-12-2008
		JP 5260642 B2	14-08-2013
		AU 2008265241 A1	24-12-2008
		IN 310426 A1	05-04-2019
		CA 2689344 A1	24-12-2008
		CN 101690329 A	31-03-2010
		KR 101508402 B1	06-04-2015
		AT E522113 T1	15-09-2011
		BR PI0813376 A2	16-05-2017
		BR 122020015813 B1	12-01-2021
		MY 151679 A	30-06-2014
		PT 2156682 E	30-11-2011
		PL 2156682 T3	31-01-2012
		MA 31522 B1	01-07-2010