



(51) International Patent Classification:

*H04M 3/436* (2006.01)      *H04W 4/16* (2009.01)  
*H04M 3/42* (2006.01)      *H04L 65/1069* (2022.01)

(21) International Application Number:

PCT/IN2024/050860

(22) International Filing Date:

18 June 2024 (18.06.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

202321045575      06 July 2023 (06.07.2023)      IN

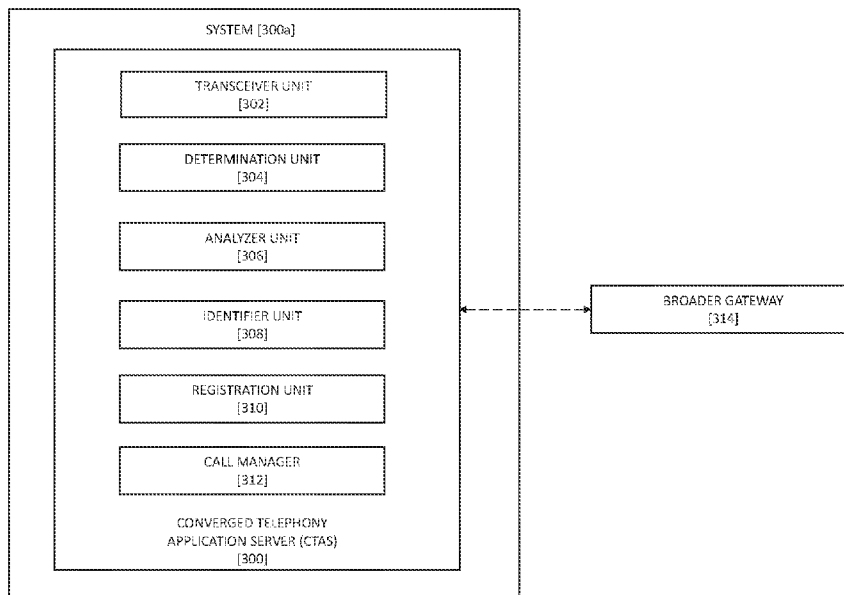
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(54) Title: METHOD AND SYSTEM FOR USING AN OPERATOR SPECIFIC CALL DURATION TIMER AND RINGING TIMER

FIG. 3



(57) Abstract: The present disclosure relates to a method and system for using an operator specific call duration timer and ringing timer. The method encompasses determining, by a determination unit [304] at a converged telephony application server (CTAS) [300], a role of a node as one of a terminating role, and an originating role; performing, by an analyzer unit [306] at the CTAS [300], one of an originating role procedure and a terminating role procedure; identifying, by an identification unit [308] at the CTAS [300], one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure, and the terminating role procedure; and registering, by a registration unit [310] at the CTAS [300], a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.



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(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

**Published:**

- *with international search report (Art. 21(3))*

## METHOD AND SYSTEM FOR USING AN OPERATOR SPECIFIC CALL DURATION TIMER AND RINGING TIMER

### TECHNICAL FIELD

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[0001] Embodiments of the present disclosure generally relate to the field of wireless communication systems. More particularly, the present disclosure relates to a method and system for using an operator specific call duration timer and ringing timer.

### 10 BACKGROUND

[0002] 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  
15 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.

[0003] Wireless communication technology has rapidly evolved over the past few decades, with each generation bringing significant improvements and advancements. The first generation of  
20 wireless communication technology was based on analog technology and offered only voice services. However, with the advent of the second generation (2G) technology, digital communication and data services became possible, and text messaging was introduced. Third generation (3G) technology marked the introduction of high-speed internet access, mobile video calling, and location-based services. The fourth generation (4G) technology revolutionized  
25 wireless communication with faster data speeds, better network coverage, and improved security. Currently, the fifth generation (5G) technology is being deployed, promising even faster data speeds, low latency, and the ability to connect multiple devices simultaneously. With each generation, wireless communication technology has become more advanced, sophisticated, and capable of delivering more services to its users.

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[0004] In cellular technology, a called-party is a person who (or device that) answers a telephone call, and a called-party handset is a device that receives a telephone call. Also, a caller party is a person who initiates a phone call, and a caller-party handset is a device that initiates a telephone call. Also, in cellular technology, a ringing duration is the time between the first ring observed at  
35 the called-party handset and the time at which the call is picked up, and a call duration time is the

time for which the calling party and the called party are conversing. Conventionally, telecom operators do not follow any standard principle regarding ringing duration and maximum call duration time. High ringing timer and long call duration timer often leads to unnecessary utilization of network resources.

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[0005] In order to provide separate ringing and call duration timer for every network operator (or referred herein as an operator or a network service provider), the most important aspect is to identify the operator associated with user device(s) of the users of a communication network. However, existing systems are largely dependent on mobile number portability (MNP) query to obtain the operator details irrespective of whether the application server is serving the calling party or the called party.

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[0006] Further, over the period of time various solutions have been developed to improve the performance of communication devices and to separate ringing and call duration timer for different operators. However, there are certain challenges with existing solutions.

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[0007] Presently, mobile number portability is available to most of the users around the world. Once mobile number portability is allowed, the same country code and national destination code (CC-NDC) can belong to different operators. The CC indicates a numerical prefix assigned to each country or territory by an International Telecommunication Union (ITU). The National Destination Code (NDC) may also be known as an "area code" or "city code" within a country's numbering plan. It specifies a particular geographic area or region within the country. Hence, to identify an operator of a user of a communication network (or referred herein as a network), the network must perform a mobile number portability (MNP) query. This service is generally performed in serving telephony application server (TAS) of the calling party to identify routing number and destination operator of the called party, wherein the routing number is a unique identifier or code used within the telecommunications network to direct the call or message to the appropriate operator handling the ported mobile number. In particular, when the application server serves the calling party, MNP query and number analysis are performed. The TAS is a type of server used in telecommunication networks to provide various telephony services and applications. However, when the application server serves the called party, again MNP query needs to be performed to identify the operator of the calling party. Considering an equal number of outgoing and incoming calls, this leads to heavy traffic on mobile network portability (MNP) server. In most cases, the traffic on the MNP server can be increased by 100%, which in return requires capacity augmentation and more capex investment.

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[0008] Thus, there exists an imperative need in the art to provide a method or system that can ensure registration of call duration timer and ringing timer for different operators without any capacity augmentation and increase in traffic.

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## **OBJECTS OF THE INVENTION**

[0009] Some of the objects of the present disclosure, which at least one embodiment disclosed herein satisfies are listed herein below.

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[0010] It is an object of the present disclosure to provide a system and a method for segregating call duration timer and ringing timer for different telecom operators.

[0011] It is another object of the present disclosure to provide a solution that standardizes ringing duration and maximum call duration time.

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[0012] It is yet another object of the present disclosure to provide a solution that substantially reduces unnecessary utilization of network resources.

[0013] It is yet another object of the present disclosure to provide a solution that substantially reduces overburdening traffic on the mobile network portability (MNP) server.

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[0014] It is yet another object of the present disclosure to provide a solution for the segregation of call duration timer and ringing timer for different operators that does not require major capacity augmentation.

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[0015] It is yet another object of the present disclosure to provide a solution for the segregation of call duration timer and ringing timer for different operators that does not require major capex investment.

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[0016] It is yet another object of the present disclosure to provide a solution for the segregation of call duration timer and ringing timer for different operators that is not dependent on MNP query when the application server is serving the called party.

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## **SUMMARY**

[0017] This section is provided to introduce certain aspects of the present disclosure 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.

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[0018] An aspect of the present disclosure may relate to a method for using an operator specific call duration timer and ringing timer. The method comprises determining, by a determination unit at a converged telephony application server (CTAS), a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role. The method further comprises performing, by an analyzer unit at the CTAS, one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role. The method further comprises identifying, by an identification unit at the CTAS, one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure and the terminating role procedure. The method further comprises registering, by a registration unit at the CTAS, a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

20 [0019] In an exemplary aspect of the present disclosure, prior to the determining, by the determination unit at the CTAS, the role of the node, the method further comprises receiving, by a transceiver unit of the CTAS, a session initiation protocol (SIP) invite, wherein the SIP invite is received upon initiation of a call session from a calling party to a called party.

25 [0020] In an exemplary aspect of the present disclosure, the originating role procedure comprises performing, by an analyzer unit at the CTAS, a mobile number portability (MNP) query, to identify the called party operator.

[0021] In an exemplary aspect of the present disclosure, the terminating role procedure comprises adding, by the analyzer unit at the CTAS via a border gateway, a user-agent header in one or more data packets related to the call session; identifying, by the analyzer unit at the CTAS, the calling party operator based on the user-agent header added by the border gateway.

30 [0022] In an exemplary aspect of the present disclosure, the call duration timer and the ringing timer are defined in one or more local files associated with one or more operators.

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[0023] In an exemplary aspect of the present disclosure, the method further comprises disconnecting, by a call manager at the CTAS, the call session upon expiry of one of the call duration timer and the ringing timer.

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[0024] Another aspect of the present disclosure may relate to a system for using an operator specific call duration timer and an operator specific ringing timer. The system comprises a determination unit configured to determine a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role. The system further comprises an analyzer unit connected to at least the determination unit, the analyzer unit being configured to perform one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role. The system further comprises an identification unit connected to at least the analyzer unit, the identification unit being configured to identify one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure and the terminating role procedure. The system further comprises a registration unit connected to at least the identification unit, the registration unit being configured to register a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

[0025] Yet another aspect of the present disclosure may relate to a non-transitory computer readable storage medium storing instructions for using an operator specific call duration timer and an operator specific ringing timer, the instructions include executable code which, when executed by one or more units of a system, causes: a determination unit of the system to determine a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role; an analyzer unit of the system to perform one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role; an identification unit of the system to identify one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure, and the terminating role procedure; a registration unit of the system to register a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

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[0026] Yet another aspect of the present disclosure may relate to a user equipment (UE), wherein the UE is a called party. The UE comprises a transceiver unit that is configured to receive a call, and. The call is received at the UE based on an operator specific call duration timer and an operator specific ringing timer. The operator specific call duration timer and the operator specific ringing timer is determined by a converged telephony application server (CTAS) based on: determining, by a determination unit at the CTAS, a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role; performing, by an analyzer unit at the CTAS, one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role; identifying, by an identification unit at the CTAS, one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure, and the terminating role procedure; and registering, by a registration unit at the CTAS, a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

## DESCRIPTION OF THE DRAWINGS

[0027] 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. 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. It will be appreciated by those skilled in the art that disclosure of such drawings includes disclosure of electrical components or circuitry commonly used to implement such components.

[0028] FIG. 1 illustrates an exemplary block diagram representing interconnection between a system and a network entity, in accordance with exemplary implementations of the present disclosure.

[0029] FIG. 2 illustrates an exemplary block diagram of a computing device upon which the features of the present disclosure may be implemented in accordance with exemplary implementation of the present disclosure.

[0030] Fig. 3 illustrates an exemplary block diagram of a system for using an operator specific call duration timer and an operator specific ringing timer, in accordance with exemplary implementations of the present disclosure.

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[0031] Fig. 4 illustrates a method flow diagram for using an operator specific call duration timer and an operator specific ringing timer, in accordance with exemplary implementations of the present disclosure.

10 [0032] Fig. 5 illustrates an exemplary flow chart for indicating the process for segregation of call duration timer and ringing timer for different operators, in accordance with exemplary implementations of the present disclosure.

#### DETAILED DESCRIPTION

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[0033] 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 may not address any of the problems discussed above or might address only some of the problems discussed above.

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[0034] 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 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.

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[0035] 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.

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[0036] Further, in accordance with the present disclosure, it is to be acknowledged that the functionality described for the various components/units can be implemented interchangeably. While specific embodiments may disclose a particular functionality of these units for clarity, it is recognized that various configurations and combinations thereof are within the scope of the disclosure. The functionality of specific units as disclosed in the disclosure should not be construed as limiting the scope of the present disclosure. Consequently, alternative arrangements and substitutions of units, provided they achieve the intended functionality described herein, are considered to be encompassed within the scope of the present disclosure.

[0037] Also, it is noted that individual embodiments may be described as a process which is depicted 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.

[0038] 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 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.

[0039] 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 (Digital Signal Processing) DSP core, a controller, a microcontroller, Application 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.

[0040] 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” 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 general-purpose computer, desktop, personal digital assistant, tablet computer, wearable device or any other computing device which is capable of implementing at least some of the features of the present disclosure. Also, the user device may contain at least one input means configured to receive an input from unit(s) which are required to implement one or more features of the present disclosure.

[0041] As used herein, “storage unit” or “memory unit” refers to a machine or computer-readable medium including any mechanism for storing information in a form readable by a computer or similar machine. For example, a computer-readable medium includes read-only memory (“ROM”), random access memory (“RAM”), magnetic disk storage media, optical storage media, flash memory devices or other types of machine-accessible storage media. The storage unit stores at least the data that may be required by one or more units of the system to perform their respective functions.

[0042] As used herein “interface” or “user interface refers to a shared boundary across which two or more separate components of a system exchange information or data. The interface may also be referred to a set of rules or protocols that define communication or interaction of one or more modules or one or more units with each other, which also includes the methods, functions, or procedures that may be called.

[0043] All modules, units, components used herein, unless explicitly excluded herein, may be software modules or hardware processors, the processors being a general-purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASIC), Field Programmable Gate Array circuits (FPGA), any other type of integrated circuits, etc.

[0044] As used herein the transceiver unit includes at least one receiver and at least one transmitter configured respectively for receiving and transmitting data, signals, information, or a combination thereof between units/components within the system and/or connected with the system.

5 [0045] As discussed in the background section, the current known solutions for separating ringing and call duration timer for different operators have several shortcomings such as unnecessary utilization of network resources, increased traffic on a Mobile Number Portability (MNP) server and increased capex investment. The present disclosure aims to overcome the above-mentioned and other existing problems in this field of technology by providing method and system for using  
10 an operator specific call duration timer and an operator specific ringing timer.

[0046] The present disclosure aims to overcome the above-mentioned and other existing problems in this field of technology by employing border gateways such as Media Gateway Control Function (MGCF) or a Session Border Controller (SBC), wherein the MGCF is a gateway between  
15 traditional circuit-switched networks (such as Public Switched Telephone Network (PSTN) and packet-switched networks (such as IP-based networks)), and the SBC is a gateway that is designed to regulate and secure communication sessions between different networks or endpoints. The MGCF and/or the SBC are configured to add unique user-agent header(s) in communication signalling messages exchanged between network elements that can be unique for every operator,  
20 wherein these user-agent header(s) are used to identify calling-party operator when the called party is served by a Converged Telephony Application Server (CTAS).

[0047] Once the calling-party operator is identified, a registration unit at the CTAS records and manages timers, such as call duration and ringing timers, based on the identified operator, ensuring  
25 efficient session management. Overall, this orchestrated process within the CTAS optimizes call handling and resource allocation in telecommunications networks. This way the CTAS may dynamically adjust call parameters or Quality of Service (QoS) settings to optimize network resources and ensure a satisfactory communication experience.

30 [0048] FIG. 1 illustrates an exemplary block diagram [100] representing interconnection between a system [100a] and a network entity [101], in accordance with exemplary implementation of the present disclosure. As shown in FIG. 1, the system [100a] is connected with the network entity [101]. The system [100a] comprises a Converged Telephony Application Server (CTAS) [300] and is implemented using an operator specific call duration timer and an operator specific ringing

timer. Further, detailed functionality of the system [100a] (hereinafter the system [100a] is referred to as system [300a]) is explained in the description of FIG.3 as provided below.

[0049] Figure. 2 illustrates an exemplary block diagram of a computing device [200] (or referred to herein as a computer system [200]) upon which the features of the present disclosure may be implemented in accordance with exemplary implementation of the present disclosure. In an implementation, the computing device [200] may also implement a method for using an operator specific call duration timer and an operator specific ringing timer utilising the system. In another implementation, the computing device [200] itself implements the method for using an operator specific call duration timer and an operator specific ringing timer using one or more units configured within the computing device [200], wherein said one or more units are capable of implementing the features as disclosed in the present disclosure.

[0050] The computing device [200] may include a bus [202] or other communication mechanism for communicating information, and a hardware processor [204] coupled with bus [202] for processing information. The hardware processor [204] may be, for example, a general-purpose microprocessor. The computing device [200] may also include a main memory [206], such as a random-access memory (RAM), or other dynamic storage device, coupled to the bus [202] for storing information and instructions to be executed by the processor [204]. The main memory [206] also may be used for storing temporary variables or other intermediate information during execution of the instructions to be executed by the processor [204]. Such instructions, when stored in non-transitory storage media accessible to the processor [204], render the computing device [200] into a special-purpose machine that is customized to perform the operations specified in the instructions. The computing device [200] further includes a read only memory (ROM) [208] or other static storage device coupled to the bus [202] for storing static information and instructions for the processor [204].

[0051] A storage device [210], such as a magnetic disk, optical disk, or solid-state drive is provided and coupled to the bus [202] for storing information and instructions. The computing device [200] may be coupled via the bus [202] to a display [212], such as a cathode ray tube (CRT), Liquid crystal Display (LCD), Light Emitting Diode (LED) display, Organic LED (OLED) display, etc. for displaying information to a computer user. An input device [214], including alphanumeric and other keys, touch screen input means, etc. may be coupled to the bus [202] for communicating information and command selections to the processor [204]. Another type of user input device may be a cursor controller [216], such as a mouse, a trackball, or cursor direction

keys, for communicating direction information and command selections to the processor [204], and for controlling cursor movement on the display [212]. This input device typically has two degrees of freedom in two axes, a first axis (e.g., x) and a second axis (e.g., y), that allow the device to specify positions in a plane.

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[0052] The computing device [200] may implement the techniques described herein using customized hard-wired logic, one or more ASICs or FPGAs, firmware, and/or program logic which in combination with the computing device [200] causes or programs the computing device [200] to be a special-purpose machine. According to one implementation, the techniques herein are performed by the computing device [200] in response to the processor [204] executing one or more sequences of one or more instructions contained in the main memory [206]. Such instructions may be read into the main memory [206] from another storage medium, such as the storage device [210]. Execution of the sequences of instructions contained in the main memory [206] causes the processor [204] to perform the process steps described herein. In alternative implementations of the present disclosure, hard-wired circuitry may be used in place of or in combination with software instructions.

[0053] The computing device [200] also may include a communication interface [218] coupled to the bus [202]. The communication interface [218] provides a two-way data communication coupling to a network link [220] that is connected to a local network [222]. For example, the communication interface [218] may be an integrated services digital network (ISDN) card, cable modem, satellite modem, or a modem to provide a data communication connection to a corresponding type of telephone line. As another example, the communication interface [218] may be a local area network (LAN) card to provide a data communication connection to a compatible LAN. Wireless links may also be implemented. In any such implementation, the communication interface [218] sends and receives electrical, electromagnetic, or optical signals that carry digital data streams representing various types of information.

[0054] The computing device [200] can send messages and receive data, including program code, through the network(s), the network link [220] and the communication interface [218]. In the Internet example, a server [230] might transmit a requested code for an application program through the Internet [228], the ISP [226], the local network [222], the host [224] and the communication interface [218]. The received code may be executed by the processor [204] as it is received, and/or stored in the storage device [210], or other non-volatile storage for later execution.

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[0055] Referring to FIG. 3, an exemplary block diagram of a system [300a] for using an operator specific call duration timer and an operator specific ringing timer, is shown, in accordance with the exemplary implementations of the present disclosure. The system [300a] comprises at least one converged telephony application server (CTAS) [300], wherein the CTAS [300] further comprises at least one transceiver unit [302], at least one determination unit [304], at least one analyzer unit [306], at least one identifier unit [308], at least one registration unit [310], and at least one call manager [312]. Further, the CTAS [300] is connected to a broader gateway [314]. Also, all the components/ units of the system [300a] are assumed to be connected to each other unless otherwise indicated below. Also, in Figure. 3 only a few units are shown, however, the system [300a] may comprise multiple such units or the system [300a] may comprise any such numbers of said units, as required to implement the features of the present disclosure. Further, in an implementation, the system [300a] may be in communication with at least a network entity [101] or a communication network.

[0056] The system [300a] is configured for using an operator specific call duration timer and an operator specific ringing timer, with the help of the interconnection between the components/units of the system [300a].

[0057] The term “ringing duration” herein may refer to the time between the first ring observed at the called-party handset and the time at which the call is picked up at the called-party handset. Further, the called party is a person who (or device that) receives a telephone call, and a called party handset is a device that receives a telephone call. A caller-party handset is a device that initiates a telephone call to the called party. A caller party is a person who initiates a phone call. The operator-specific call duration timer is a timer set by a network operator to limit the duration of calls made by subscribers. It ensures that calls do not exceed a predefined duration, which can help in managing network resources efficiently and controlling subscriber usage patterns. The operator specific ringing timer is a timer set by the network operator to control the duration for which a phone rings before it is diverted to voicemail or another destination. It allows operators to customize ringing durations based on their service offerings and subscriber preferences.

[0058] The term “call duration time” herein may refer to the time for which the calling party and the called party are conversing.

[0059] For using the operator specific call duration timer and the operator specific ringing timer, initially the transceiver unit [302] of the system [300a] may receive at the converged telephony

application server (CTAS) [300], a session initiation protocol (SIP) invite, wherein the SIP invite is received upon initiation of a call session from the calling party to the called party. The call session refers to the duration during which a telephone call or communication session takes place between two or more parties. The SIP invite refers to a SIP request message that initiates a SIP call. The SIP request message is a type of message used in SIP-based communication systems to initiate, modify, or terminate communication sessions. A SIP call refers to a communication session initiated and managed using the SIP.

[0060] The SIP Invite (or SIP INVITE) is a message used in the SIP, which is a signaling protocol used for initiating, managing, and terminating real-time communication sessions over IP networks.

[0061] Upon receiving the SIP invite, the CTAS [300] examines a private (P) header that serves user, to identify a role of a node. As used herein the “node” refers to the entity or device participating in the communication session. Further, the node may be a network element, for example a base station server or any other server that implements a relevant function using which a calling party makes a call to the called party or the called party receives a call from a calling party. If the node is connected to the calling party, the role of the node may be determined as an originating role, and if the node is connected to the called party, the role of the node may be determined as a terminating role.

[0062] The private (P) header is a header field, designated as "private" or denoted by the letter "P," is part of SIP protocol. The specific content and purpose of the private (P) header can vary depending on the requirements and capabilities of the system [300a] or application implementing it. For example, it might be used to transmit proprietary user identification, session parameters, service preferences, or other application-specific data. More specifically, upon receiving the SIP invite, the determination unit [304] of the system [300a] is configured to determine the role of the node, wherein the role of the node is determined as one of a terminating role and an originating role.

[0063] The term “terminating role” herein may correspond to the role played by a network node or endpoint that is the recipient or destination of a communication session. A communication session refers to a period of time during which two or more parties engage in communication, typically through a specific medium or channel.

[0064] The term “originating role” herein may correspond to the role played by a network node that initiates the communication session or sends out the communication request or invite to start the session.

5 [0065] It is to be noted that the calling party refers to a person who initiates a phone call and the called party refers to a person who answers a phone call.

[0066] The term “SIP” herein may correspond to a signalling protocol used for initiating, maintaining, and terminating communication sessions.

10

[0067] The term “CTAS” herein may correspond to a type of server or platform within a telecommunications network that facilitates the delivery of telephony services by integrating various communication technologies and protocols. The CTAS serves as a centralized platform for hosting and executing telephony applications, including call control functions, supplementary  
15 services, and multimedia services. In an implementation the CTAS is a telecommunication network element that provides telephony services and applications in converged fixed-mobile networks.

[0068] After determining role of the node, the analyzer unit [306] performs one of an originating  
20 role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role.

[0069] In one implementation, to perform originating role procedure, the analyzer unit [306] may  
25 perform a mobile number portability (MNP) query, to identify a called party operator. If the role of the node is originating role, then the called party operator is found out by using a number analysis service such as Mobile Number Portability (MNP). Performing the MNP query involves the process of querying a centralized database or system to determine the current operator or service provider associated with the called party (e.g., a given mobile phone number). The process  
30 of the MNP query works as follows: when a call is initiated and the CTAS [300] determines that it needs to perform the originating role procedure, the analyzer unit [306] triggers the MNP query process. The analyzer unit [306] sends a request to a MNP database or system, providing the phone number of the called party as the input parameter for the query. The MNP database receives the query and performs a lookup operation to determine the current operator associated with the  
35 provided phone number. The MNP database contains information about all mobile phone numbers

that have been ported between different operators. Once the database lookup is completed, a MNP system returns the result of the query to the analyzer unit [306]. This result typically includes the identity of the current operator or service provider associated with the called party's phone number.

5 [0070] The MNP query refers to a process in telecommunications where a network or service provider queries a centralized database to determine the current network operator associated with a specific mobile phone number.

10 [0071] The “operator” is an entity that operates or manages the communication network or infrastructure through which the SIP communication is facilitated.

[0072] The analyzer unit [306], for performing the terminating role procedure, adds, via a border gateway [314], a user-agent header in one or more data packets related to the call session and identifies a calling party operator based on the user-agent header added by the border gateway  
15 [314]. The one or more data packets refers to the packets being transmitted over the network during a call session. These packets could contain various types of data, depending on the nature of the call (e.g., voice data, video data, and signalling information). The user-agent header is a piece of metadata (e.g., name and version of a web browser, VoIP client, or messaging application, device information, etc.) added to one or more data packets during a communication session, typically in  
20 the context of internet protocols like HTTP or SIP (Session Initiation Protocol). If role of the node is “terminating role”, then the CTAS [300] examines the user-agent header to identify the calling party’s operator.

[0073] It is to be noted that border gateways (such as Media Gateway Control Function (MGCF)  
25 or Session Border Controller (SBC)) are the entry point of signaling traffic coming from other operators. These entities are configured to add user-agent header which can be unique for every operator. It is to be noted that when relaying requests originating from other operators to the CTAS [300], these border gateways [314] append their distinct user-agent headers. The user-agent header appended by the border gateway [314] removes the dependency of the MNP query when an  
30 application server is serving the called party.

[0074] Further, the identification unit [308] is configured to identify one of the calling party operator and the called party operator, based on the performing of one of the originating role procedure and the terminating role procedure.

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[0075] The calling party operator is the telecommunication service provider that serves the party initiating the communication session (i.e., the caller). It represents the network operator or service provider associated with the subscriber making the call. The called party operator is the telecommunication service provider that serves the party receiving the communication session (i.e., the callee). It represents the network operator or service provider associated with the subscriber receiving the call.

[0076] It is to be noted that, when the calling party belongs to users served by the CTAS [300], it is easy to identify the operator of the called party by number analysis of the called party with the help of the MNP service. Hence both the ringing and session or call duration timer can be registered based on the destination operator. So, the present disclosure provides a solution that can be applied easily at the CTAS [300] serving the calling party. On the other hand, in the case of an incoming call i.e., when the called party is served by the CTAS [300], the calling party's operator needs to be identified for registering separate timers for different operators. In this case, border Gateways (MGCF or SBC) become the entry point of signaling traffic coming from other operators. These entities are configured to add the user-agent header which can be unique for every operator and is used to identify the corresponding calling party's operator.

[0077] Once the calling party operator or the called party operator is identified, the registration unit [310] registers a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

[0078] It is to be noted that the call duration timer and the ringing timer are defined in one or more local files associated with one or more operators. This allows for the segregation of the call duration timer and the ringing timer for different operators. Once the operator is identified (for example, operator 1 or operator 2), the CTAS [300] registers separate ringing time and call duration timer that are defined in its local file against the identified operator.

[0079] In an implementation, the call manager [312] at the CTAS [300] disconnects the call session upon expiry of one of the call duration timer and the ringing timer. Therefore, once the registered timers expire, the CTAS [300] disconnects the call. The call manager is a component of the CTAS [300] that is responsible for managing and controlling the establishment, maintenance, and termination of calls within the network.

[0080] Referring to FIG. 4, an exemplary method flow diagram [400] for using an operator specific call duration timer and an operator specific ringing timer, in accordance with exemplary implementations of the present disclosure is shown. In an implementation the method [400] is performed by the system [300a]. Also, as shown in Figure 4, the method [400] starts at step [402].

5

[0081] At step [404], the method comprises determining, by a determination unit [304] at a converged telephony application server (CTAS) [300], a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role. The terminating role corresponds to role played by a network node or endpoint that is the recipient or destination of a communication session. The originating role corresponds to the role played by a network node that initiates the communication session or sends out the communication request or invite to start the session.

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[0082] In one implementation, prior to the determining, by the determination unit [304] at the CTAS [300], the role of the node, the method further comprises receiving, by a transceiver unit [302] of the CTAS [300], a session initiation protocol (SIP) invite, wherein the SIP invite is received upon initiation of a call session from a calling party to a called party. The SIP is a signalling protocol used for initiating, maintaining, and terminating communication sessions.

15

[0083] Also, the CTAS corresponds to a type of server within a telecommunications network that facilitates the delivery of telephony services by integrating various communication technologies and protocols.

20

[0084] Upon receiving the SIP invite, the CTAS [300] examines a private (P) header served user to identify a role of a node. If the role of the node is "originating" (also referred as "orig"), then a called party operator is found out by using a number analysis service such as a Mobile Number Portability (MNP). The private (P) header is a header field, designated as "private" or denoted by the letter "P," is part of the SIP protocol. The specific content and purpose of the private (P) header served user can vary depending on the requirements and capabilities of the system or application implementing it. For example, it might be used to transmit proprietary user identification, session parameters, service preferences, or other application-specific data. More specifically, upon receiving the SIP invite, the determination unit [304] determines the role of the node, wherein the role of the node is determined as one of the terminating role and the originating role.

25

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[0085] At step [406], the method comprises performing, by an analyzer unit [306] at the CTAS [300], one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role.

[0086] The originating role procedure further comprises performing, by the analyzer unit [306] at the CTAS [300], a MNP query, to identify the called party operator. It is to be noted that if role of the node is originating role, then the called party operator is found out by using a Number Analysis service such as the MNP.. The operator is an entity that operates or manages the communication network or infrastructure through which the SIP communication is facilitated.

[0087] The terminating role procedure further comprises adding, by the analyzer unit [306] at the CTAS [300] via a border gateway [314], a user-agent header in one or more data packets related to the call session. The user-agent header is a characteristic string that lets servers and network peers identify the application, operating system, vendor, and/or version of the requesting user agent.

[0088] If role of the node is terminating role, then the CTAS [300] examines the user-agent header to identify the calling party's operator.

[0089] It is to be noted that border gateways (such as Media Gateway Control Function (MGCF) or Session Border Controller (SBC)) are the entry point of signaling traffic coming from other operators. These entities are configured to add a user-agent header which can be unique for every operator. It is to be noted that when relaying requests originating from other operators to the CTAS [300], these border gateways append their distinct user-agent headers. The user-agent header appended by the border gateway [314] removes the dependency of the MNP query when an application server is serving the called party.

[0090] At step [408], the method comprises identifying, by an identification unit [308] at the CTAS [300], one of the calling party operator and the called party operator, based on the performing of one of the originating role procedure and the terminating role procedure.

[0091] It is to be noted that, when the calling party belongs to users served by the CTAS [300], it is easy to identify the operator of the called party by number analysis of the called party with the

help of the MNP service. Hence both the ringing and session or call duration timer can be registered based on the destination operator. So, the present disclosure provides a solution that can be applied easily at the CTAS [300] serving the calling party. On the other hand, in the case of an incoming call i.e., when the called party is served by the CTAS [300], the calling party's operator  
5 needs to be identified for registering separate timers for different operators. In this case, border gateways (MGCF or SBC) become the entry point for signaling traffic coming from other operators. These entities are configured to add the user-agent header which can be unique for every operator and is used to identify the corresponding calling party's operator.

10 **[0092]** At step [410], the method comprises registering, by a registration unit [310] at the CTAS [300], a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

15 **[0093]** The call duration timer and the ringing timer are defined in one or more local files associated with one or more operators. This allows segregation of the call duration timer and the ringing timer for different operators. Once the operator (for example, operator 1 or operator 2) is identified, the CTAS [300] registers separate ringing time and call duration timer is defined in its local file against the identified operator.

20 **[0094]** The method further comprises disconnecting, by a call manager [312] at the CTAS [300], the call session upon expiry of one of the call duration timer and the ringing timer.

**[0095]** The term "call manager" is a component of the CTAS [300] responsible for managing and controlling the establishment, maintenance, and termination of calls within the system [300a].

25

**[0096]** Thereafter, the method terminates at step [412].

**[0097]** **FIG. 5** illustrates an exemplary flow chart [500] for indicating a process for segregation of call duration timer and ringing timer for different operators, in accordance with exemplary  
30 embodiments of the present disclosure. As shown in Figure 5, the process starts at step [502]. It is important to note that a call duration timer and a ringing timer are defined in one or more local files that are associated with one or more calling party operators and/or one or more caller party operators.

[0098] At step [504], a converged telephony application server (CTAS) [300] receives a session initiation protocol (SIP) invite upon initiation of a call session to initiate a call from a calling party to a called party and further determines a role of a node at step [506]. If role of the node is identified as originating (also referred to as “orig”) role then the at step [508], the CTAS [300] performs a  
5 Mobile Number Portability (MNP) query to identify a called party’s operator, wherein the originating role indicates that the node is a network node that initiated the call session or sent out the communication request or invite to start the call session. Once the operator is identified as an operator 1 or operator 2 (as indicated [508a] and [508b] respectively in FIG.5), the CTAS [300] registers a separate ringing timer and call duration timer (e.g., Register timer 1 according to  
10 operator 1 and register timer 2 according to operator 2) defined in its local file against the identified operator, at step [510A] or [510B] respectively.

[0099] If a role of the node is identified as terminating (also referred to as “term”) role then at step [512], the CTAS [300] determines a user-agent header added in one or more data packets related  
15 to the call session to register a call duration timer and a ringing timer based on the identified called party operator. The user-agent header is appended by the border gateway [314] that removes the dependency of the MNP query of calling party to get operator details when the application server is serving the called party. Once the operator is identified using the agent header then the call duration timer and ringing timer are registered for such operator. For example, according to the  
20 identified operator(s), the call duration timer and ringing timer are registered in local files. Once the registered timers expire, the CTAS [300] via a call manager disconnects the call.

[0100] The present disclosure further discloses a non-transitory computer readable storage medium storing instructions for using an operator specific call duration timer and ringing timer,  
25 the instructions include executable code which, when executed by one or more units of a system [300a], causes: a determination unit [304] of the system [300a] to determine a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role; an analyzer unit [306] of the system [300a] to perform one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the  
30 role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role; an identification unit [308] of the system [300a] to identify one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure, and the terminating role procedure; a registration unit [310] of the system [300a] to register a call duration timer and

a ringing timer based on the identified one of the calling party operator and the called party operator.

[0101] Yet another aspect of the present disclosure may relate to a user equipment (UE). The UE comprises a transceiver unit [302] that configured to receive a call. The UE is a called party. The call is received at the UE based on an operator specific call duration timer and an operator specific ringing timer. Also, the operator specific call duration timer and the operator specific ringing timer is determined by a converged telephony application server (CTAS) [300] based on: determining, by a determination unit [304] at the CTAS [300], a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role; performing, by an analyzer unit [306] at the CTAS [300], one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role; identifying, by an identification unit [308] at the CTAS [300], one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure, and the terminating role procedure; and registering, by a registration unit [310] at the CTAS [300], a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

[0102] As is evident from the above, the present disclosure provides a technically advanced solution for using an operator specific call duration timer and an operator specific ringing timer. The system and method according to the present disclosure substantially reduces overburdening traffic on a Mobile Network Portability (MNP) server without requiring major capacity augmentation. Further, the present disclosure standardizes the ringing duration and maximum call duration time for different operators, substantially reduces unnecessary utilization of network resources and does not require major capex investment. Moreover, the present method and system is not dependent on MNP query, while providing a solution for segregation of call duration timer and ringing timer for different operators when the calling party is served by the application server.

[0103] While considerable emphasis has been placed herein on the disclosed implementations, it will be appreciated that many implementations can be made and that many changes can be made to the implementations without departing from the principles of the present disclosure. These and other changes in the implementations of the present disclosure will be apparent to those skilled in the art, whereby it is to be understood that the foregoing descriptive matter to be implemented is illustrative and non-limiting.

**We Claim:**

1. A method for using an operator specific call duration timer and an operator specific ringing timer, the method comprising:

- 5       - determining, by a determination unit [304] at a converged telephony application server (CTAS) [300], a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role;
- 10       - performing, by an analyzer unit [306] at the CTAS [300], one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role;
- 15       - identifying, by an identification unit [308] at the CTAS [300], one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure and the terminating role procedure; and
- registering, by a registration unit [310] at the CTAS [300], a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

- 20       2. The method as claimed in claim 1, wherein prior to the determining, by the determination unit [304] at the CTAS [300], the role of the node, the method comprises:

- receiving, by a transceiver unit [302] of the CTAS [300], a session initiation protocol (SIP) invite, wherein the SIP invite is received upon initiation of a call session from a calling party to a called party.

- 25       3. The method as claimed in claim 1, wherein the originating role procedure comprises:

- performing, by the analyzer unit [306] at the CTAS [300], a mobile number portability (MNP) query, to identify the called party operator.

- 30       4. The method as claimed in claim 2, wherein the terminating role procedure comprises:

- adding, by the analyzer unit [306] at the CTAS [300] via a border gateway [314], a user-agent header in one or more data packets related to the call session; and
- identifying, by the analyzer unit [306] at the CTAS [300], the calling party operator based on the user-agent header added by the border gateway [314].

5. The method as claimed in claim 1, wherein the call duration timer and the ringing timer are defined in one or more local files associated with one or more operators.
6. The method as claimed in claim 2, the method further comprising:
- 5 - disconnecting, by a call manager [312] at the CTAS [300], the call session upon expiry of one of the call duration timer and the ringing timer.
7. A system [300a] for using an operator specific call duration timer and an operator specific ringing timer, the system [300a] comprising a converged telephony application server (CTAS) [300], the CTAS [300] further comprising:
- 10 - a determination unit [304] configured to determine a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role;
- an analyzer unit [306] connected to at least the determination unit [304], the analyzer unit [306] being configured to perform one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role;
- 15 - an identification unit [308] connected to at least the analyzer unit [306], the identification unit [308] being configured to identify one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure and the terminating role procedure; and
- 20 - a registration unit [310] connected to at least the identification unit [308], the registration unit [310] being configured to register a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.
- 25
8. The system [300a] as claimed in claim 7, the system [300a] further comprising a transceiver unit [302], wherein prior to the determination unit [304] determines the role of the node, the transceiver unit [302] is configured to:
- 30 - receive a session initiation protocol (SIP) invite, wherein the SIP invite is received upon initiation of a call session from a calling party to a called party.
9. The system [300a] as claimed in claim 7, wherein the analyzer unit [306], for performing the originating role procedure, is configured to:
- 35

- perform a mobile number portability (MNP) query, to identify the called party operator.

10. The system [300a] as claimed in claim 8, wherein the analyzer unit [306], for performing the terminating role procedure, is configured to:

- add, via a border gateway [314], a user-agent header in one or more data packets related to the call session; and
- identify the calling party operator based on the user-agent header added by the border gateway [314].

11. The system [300a] as claimed in claim 7, wherein the call duration timer and the ringing timer are defined in one or more local files associated with one or more operators.

12. The system [300a] as claimed in claim 8, the system [300a] further comprising:

- a call manager [312] configured to disconnect the call session upon expiry of one of the call duration timer and the ringing timer.

13. A user equipment (UE) comprising:

- a transceiver unit configured to receive a call, wherein:

the UE is a called party,

the call is received at the UE based on an operator specific call duration timer and an operator specific ringing timer, and

the operator specific call duration timer and the operator specific ringing timer is determined by a converged telephony application server (CTAS) [300] based on:

- determining, by a determination unit [304] at the CTAS [300], a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role;
- performing, by an analyzer unit [306] at the CTAS [300], one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role;
- identifying, by an identification unit [308] at the CTAS [300], one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure and the terminating role procedure; and

- registering, by a registration unit [310] at the CTAS [300], a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

- 5      **14.** A non-transitory computer readable storage medium storing instructions for using an operator specific call duration timer and ringing timer, the instructions include executable code which, when executed by one or more units of a system [300a], causes:
- 10      - a determination unit [304] of the system [300a] to determine a role of a node, wherein the role of the node is determined as one of a terminating role, and an originating role;
- 15      - an analyzer unit [306] of the system [300a] to perform one of an originating role procedure and a terminating role procedure, wherein the originating role procedure is performed in an event the role of the node is determined as the originating role, and the terminating role procedure is performed in an event the role of the node is determined as the terminating role;
- 20      - an identification unit [308] of the system [300a] to identify one of a calling party operator, and a called party operator, based on the performing of one of the originating role procedure and the terminating role procedure; and
- a registration unit [310] of the system [300a] to register a call duration timer and a ringing timer based on the identified one of the calling party operator and the called party operator.

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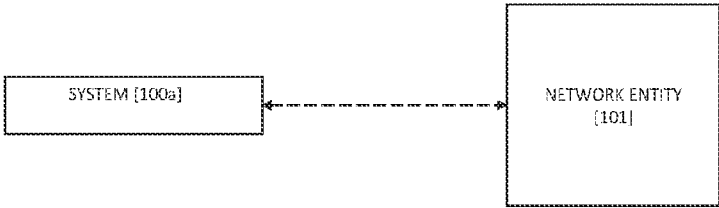


FIG. 1

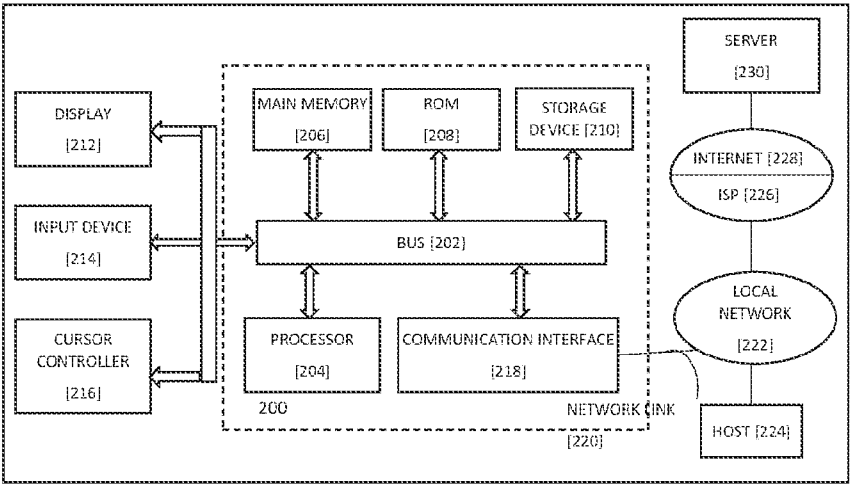


FIG. 2

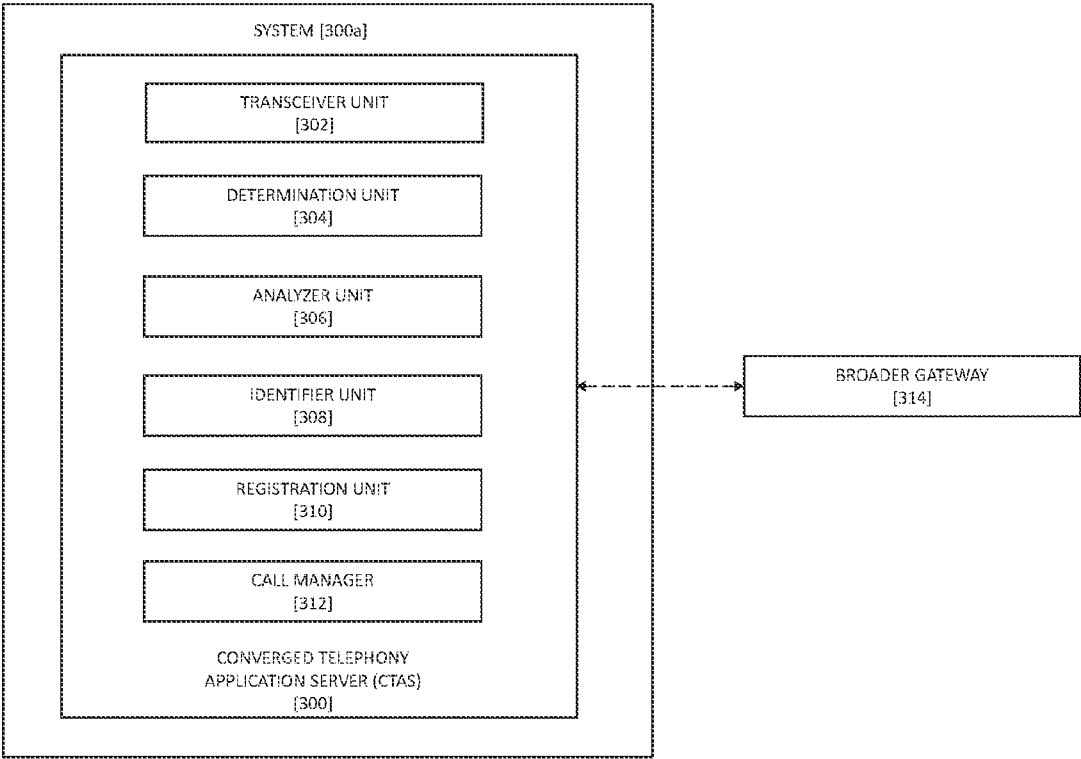


FIG. 3

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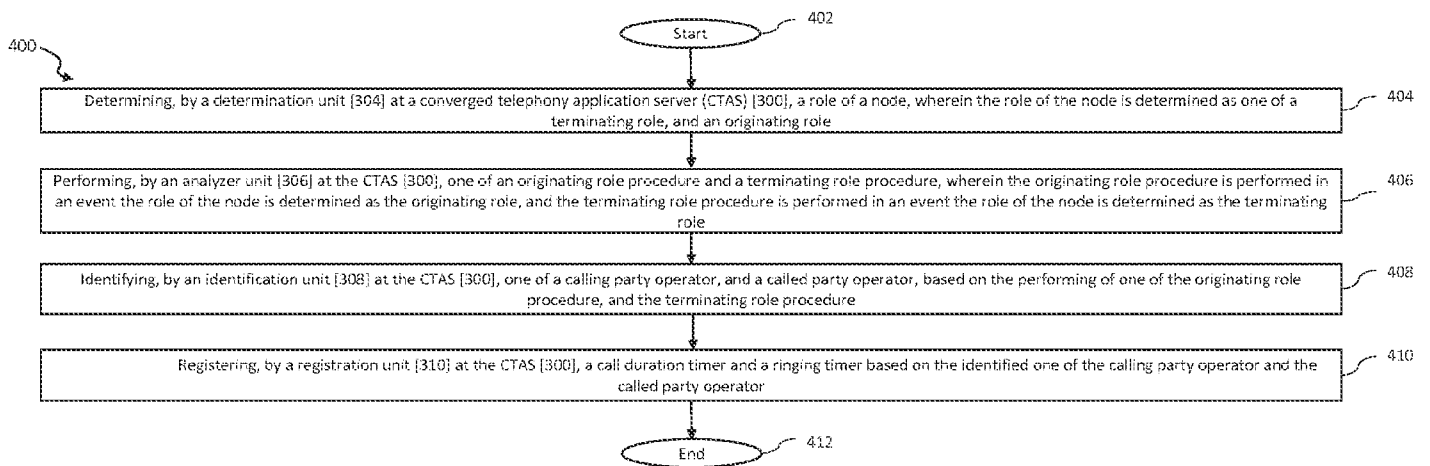


FIG. 4

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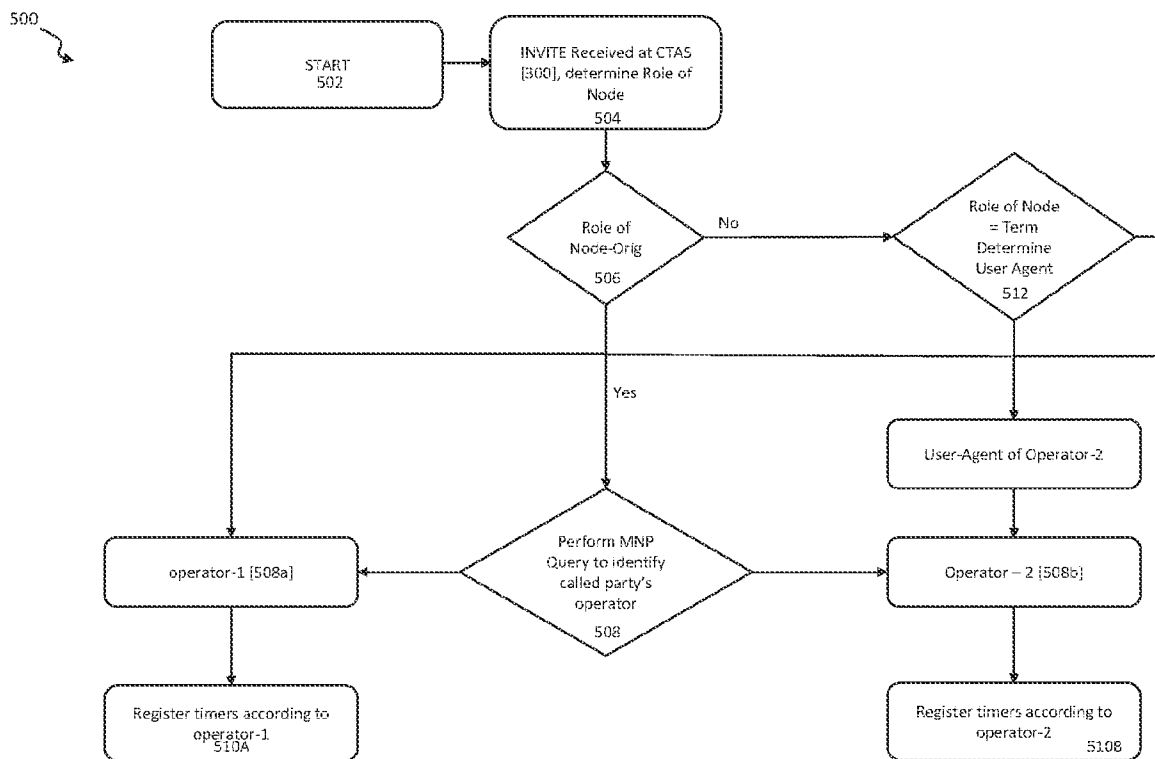


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IN2024/050860

## A. CLASSIFICATION OF SUBJECT MATTER

H04M3/436, H04M3/42, H04W4/16, H04L65/1069 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)

H04M; 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)

Databases: PatSeer, IPO Internal Database

Keywords: CTAS , call duration timer, ringing timer;

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                      | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | US20160286038A1 (UNIFY GMBH & CO KG)<br>29-09-2016 (29 September 2016)<br>Abstract;<br>Description;     | 1-14                  |
| Y         | US20110085652A1 (JONES JONATHAN)<br>14-04-2011 (14 April 2011)<br>Abstract;<br>Description;             | 1-14                  |
| Y         | US20180263066 (T MOBILE USA INC)<br>13-09-2018 (13 September 2018)<br>Abstract;<br>Description;         | 1-14                  |
| Y         | US20180213389A1 (SAMSUNG ELECTRONICS CO LTD)<br>26-06-2018 (26 July 2018 )<br>Abstract;<br>Description; | 1-14                  |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

18-10-2024

Date of mailing of the international search report

18-10-2024

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.  
PCT/IN2024/050860

| Citation          | Pub.Date   | Family           | Pub.Date   |
|-------------------|------------|------------------|------------|
| US 20160286038 A1 | 29-09-2016 | CN 106027744 A   | 12-10-2016 |
|                   |            | EP 3073720 A1    | 28-09-2016 |
| US 20110085652 A1 | 14-04-2011 | US 8406414 B2    | 26-03-2013 |
| US 20180263066 A1 | 13-09-2018 | EP 3577999 A4    | 28-10-2020 |
|                   |            | US 2018263068 A1 | 13-09-2018 |
|                   |            | CN 110383935 A   | 25-10-2019 |
|                   |            | WO 2018165578 A1 | 13-09-2018 |
| US 20180213389 A1 | 26-06-2018 | WO 2016186397 A1 | 24-11-2016 |
|                   |            | CN 107534833 A   | 02-01-2018 |
|                   |            | EP 3295694 A1    | 21-03-2018 |