

TITLE OF THE INVENTION

“Methods and systems for determining call quality at devices in a VoIP session”

CROSS REFERENCE TO RELATED APPLICATION

[001] This application is based on and derives the benefit of Singapore Provisional Application 10201703797W, the contents of which are incorporated herein by reference.

TECHNICAL FIELD

[002] Embodiments herein relate to Voice over Internet Protocol (VoIP) communication systems, and more particularly to methods and systems for determining call quality at devices and presence information of devices in a VoIP session.

BACKGROUND

[003] With network evolution and inclusion of Voice over Internet Protocol (VoIP) stacks in smart phones, users can adopt VoIP calling features using applications, which support VoIP. One of the challenges in monitoring VoIP sessions is ensuring adequate call quality over VoIP networks. The call quality may be affected due to varying reasons such as jitter buffer due to network congestion, timing drift, route changes, and so on. The network signal strength can also affect the call quality. Existing solutions can provide feedback of the call quality at the receiving end to the participants only in a one-on-one audio/video call. In an example, during a conference call over VoIP networks, the organizer of the conference call may not have the means to know the call quality at each of the receiving ends (participants). Due to a lack of information about the call quality, the organizer of the conference call may be unaware whether a particular participant of the conference call may have missed critical information from other participant(s). The organizer of the conference call may not be able to ensure whether the other participant(s) have received all types of information exchanged during the conference call.

[004] The existing systems may not be able to determine, and provide, the presence information of a subscriber(s) prior to initiating either a one-on-one audio/video call or a conference call with the subscriber(s). In an example, due to lack of presence information, a first subscriber may attempt to initiate a one-on-one audio/video call with a second

subscriber, while the second subscriber is busy (engaged in another call). The initiation attempt may end up in vain and the first subscriber is likely to get a busy tone.

[005] In an example, if a subscriber configures a device to conserve energy or radio resources, then the device can switch to inactive mode. The device may also switch to the inactive mode when there is either no activity on an application or if device is kept idle for more than a predefined time period. In such a scenario, the existing systems may indicate to other subscriber(s) that the subscriber is online or is available to receive calls. The indication can be provided until Session Initiation Protocol (SIP) registration period expires. The initiated calls, which are intended for devices that are in doze mode and/or idle mode, are likely to fail. As the communication networks are maturing in terms of mobile data connectivity, it is imperative to detect any loss/change in network connectivity as soon as possible.

OBJECTS

[006] The principal object of the embodiments herein is to disclose methods and systems for measuring call quality at the devices in the VoIP network in a multi-party VoIP call scenario and provide instant feedback to the organizer of the multi-party call, based on which the organizer of the multi-party call can perform at least one action.

[007] Another object of the embodiments herein is to periodically detect occurrence of at least one event at a device, which may lead to termination of a VoIP session by disconnection of the device from the VoIP network.

[008] Another object of the embodiments herein is to periodically analyze Real-time Transport Protocol (RTP) packets, exchanged between devices in the VoIP network during VoIP sessions, in real time.

[009] Another object of the embodiments herein is to determine call quality at the devices based on the analysis of RTP packets, and provide a feedback of the call quality by comparing the determined call quality with a predetermined threshold, wherein the predetermined threshold is based on a desired Quality of Service (QoS).

[0010] These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Many changes and modifications may be made within the

scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such modifications.

BRIEF DESCRIPTION OF FIGURES

[0011] This invention is illustrated in the accompanying drawings, through out which like reference letters indicate corresponding parts in the various figures. The embodiments herein will be better understood from the following description with reference to the drawings, in which:

[0012] FIG. 1 depicts an example Voice over Internet Protocol (VoIP) network comprising of a plurality of devices, wherein the VoIP network includes a VoIP Management Module (VMM) to determine presence information of devices in the VoIP network and a Call Quality Analyzer (CQA) to detect the call quality at the devices in the VoIP network, according to an embodiment as disclosed herein.

DETAILED DESCRIPTION

[0013] The embodiments herein and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments that are illustrated in the accompanying drawings and detailed in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

[0014] Embodiments herein disclose methods and systems for determining availability information of devices in a Voice over Internet Protocol (VoIP) network and call quality at one or more devices in the VoIP network.

[0015] Referring now to the drawings, and more particularly to FIG. 1, where similar reference characters denote corresponding features consistently throughout the figures, there are shown preferred embodiments.

[0016] FIG. 1 depicts an example VoIP network 100. As depicted in FIG. 1, the VoIP network 100 comprises of a VoIP Management Module (VMM) 101 and a plurality of devices (102a-102f, for example). The VMM 101 can include a Call Quality Analyzer (CQA) 103. In an embodiment, the VMM 101 and the CQA 103 can be included in separate modules. In another embodiment, the CQA 103 can be integrated into the VMM 101.

[0017] Each of the plurality of devices 102a-102f can enable a subscriber to avail VoIP services, by connecting to the VMM 101. Examples of the devices 102a-102f can be, but not limited to, mobile phones, smart phones, computers, laptops, tablets, wearable computing devices, Internet of Things (IoT) devices, and so on. The devices 102a-102f can be connected to the VMM 101 using at least one a wired and/or a wireless link.

[0018] The VMM 101 can determine presence information of a device by utilizing metadata associated with the device. The metadata can include protocol used for signaling and controlling a VoIP session, availability of energy and/or radio resources for handling the VoIP session, features, such as audio call, video call, supported for initiating a VoIP session, availability of speaker/camera resources in the device to accept data/video call, and so on. The VMM 101 can broadcast the presence information (available or unavailable) of the

device, to the other device(s) 102a-102f connected to the VMM 101, in the VoIP network 100. This can allow the other device(s) 102a-102f in the VoIP network 100 to either initiate or refrain from establishing a VoIP session with the device.

[0019] The VMM 101 further includes transmitting the metadata associated with the device and other relevant information such as state of the device, operating system used by the device, application using which the device is connecting to the VoIP network 100 (such as at least one of a browser, a dedicated application, and so on), availability of camera/speaker in the device to accept audio/video call, and so on, to at least one of the plurality of device(s) 102a-102f connected to the VMM 101.

[0020] In an example, the VMM 101 can determine the presence information of a device 102a and, thereafter, broadcast the presence information of the device 102a to the plurality of devices 102b-102f (VOIP clients), connected to the VMM 101. The VMM 101 can transmit the metadata associated with the device 102a and information relevant to the device 102a, to at least one of the plurality of devices 102b-102f, which may be intending to initiate a VoIP session with the device 102a. A subscriber using the device 102a can approve the at least one of the plurality of devices 102b-102f, to which the VMM 101 can transmit the metadata associated with the device 102a and information relevant to the device 102a. This can allow ensuring of privacy.

[0021] When a particular device (102a-102f) is participating in a VoIP session, the VMM 101 can update the presence information of the particular device (102a-102f). In an example, the VMM 101 can inform at least one device 102b-102f, if the device 102a is engaged in an audio call, video call, conference call, and so on. Based on the presence information, the at least one device 102b-102f can either initiate a VoIP session with the device 102a or refrain from doing so.

[0022] The VMM 101 can support multi-login feature for a subscriber, thereby enabling the subscriber to login using the same identity using multiple devices. The information is also published to followers/other users.

[0023] The connection between the VMM 101 and the devices 102a-102f can be bi-directional. The VMM 101 can be configured to detect events, which may lead to a device disconnecting from a VoIP session or losing connectivity to the VMM 101. The events can be the device connected to the VMM 101 switching to idle mode or doze mode from active mode, connecting to a different network, disconnecting from the VoIP session, maximum

number of connections limit reached, and so on. The detection of the events can be performed at periodic intervals, wherein the interval can be a predefined time period. The VMM 101 can detect the occurrence of at least one event within the predefined time period. The VMM 101 can inform at least one device about the updated presence information of the device.

[0024] In an example, if the predefined time period is 1 minute, then the VMM 101 is enabled, within a minute, to detect whether a device has switched to doze/idle mode, undergone a network change, disconnected from the VoIP network 100, and so on; that will result in the device losing connectivity to the VMM 101.

[0025] Since the VMM 101 is able to detect that if a device (102a) is offline and determine the presence information, the VMM 101 can wake up the device (102a). Consider an example, wherein the device (102a) is using a particular operating system, the VMM 101 can use VOIP push kit notifications that can wake up the device (102a) even when the VoIP session is not active. Consider an example, wherein the device (102a) switches to the doze mode to conserve battery life. In such a situation the VMM 101 can use fire base notification that can wake up the device (102a) even when the VoIP session is not active.

[0026] Embodiments herein provide presence information as detailed to a resource and feature level. This can be extensible for any new feature/element added to VoIP.

[0027] The CQA 103 can analyze Real-time Transport Protocol (RTP) packets exchanged during VoIP sessions in real time and provide feedback of call quality during VoIP sessions at each of the plurality of devices 102a-102f in the VoIP network 100. The call quality feedback during the VoIP sessions can be provided at periodic time intervals. A subscriber in the VoIP network 100 can perform at least one action based on the feedback. In an example, consider that a first subscriber, in a VoIP session with a second subscriber, detects that the call quality at the second subscriber is unacceptable, or below requirements. Thereafter, the the first subscriber can perform an action which can be, but not limited to, initiating the VoIP session on a path providing a better call quality, re-establish the VoIP session, re-establish the VoIP session after a certain time period, dial the other participant in an alternate number, and so on.

[0028] The VMM 101 can provide a copy of the RTP packets exchanged during a VoIP session between devices 102a-102f in the VoIP network 100 (through a suitable means such as port sharing) to the CQA 103. The CQA 103 can determine the call quality from the RTP packets provide the feedback on the call quality to the VMM 101. The CQA 103 can

compare the feedback on the call quality to at least one predetermined threshold. The predetermined threshold can be a Mean Opinion Score (MOS), which can be set based on a desired Quality of Service (QoS). If the call quality is below the predetermined threshold (such as being beyond the MOS score), then VMM 101 can report of the feedback of the call quality to a subscriber, accessing the call quality, informing that the call quality is below standard requirements.

[0029] Embodiments herein can ensure that critical and important information being exchanged between devices 102a-102f, connected to the VMM 101, is not missed, and QoS is maintained at the desired level.

[0030] The embodiments disclosed herein can be implemented through at least one software program running on at least one hardware device and performing network management functions to control the network elements. The network elements shown in FIG. 1 include blocks, which can be at least one of a hardware device, or a combination of hardware device and software module.

[0031] The embodiments disclosed herein describe methods and systems for determining presence information of devices in a VoIP network and call quality at the devices in the VoIP network. Therefore, it is understood that the scope of the protection is extended to such a program and in addition to a computer readable means having a message therein, such computer readable storage means contain program code means for implementation of one or more steps of the method, when the program runs on a server or mobile device or any suitable programmable device. The method is implemented in a preferred embodiment through or together with a software program written in e.g. Very high speed integrated circuit Hardware Description Language (VHDL) another programming language, or implemented by one or more VHDL or several software modules being executed on at least one hardware device. The hardware device can be any kind of portable device that can be programmed. The device may also include means, which could be e.g. hardware means like e.g. an ASIC, or a combination of hardware and software means, e.g. an ASIC and an FPGA, or at least one microprocessor and at least one memory with software modules located therein. The method embodiments described herein could be implemented partly in hardware and partly in software. Alternatively, the invention may be implemented on different hardware devices, e.g. using a plurality of CPUs.

[0032] The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein.

CLAIMS

1. A method of determining call quality at a device (102b) in a Voice over Internet Protocol (VoIP) network (100), the method comprising:

determining, by a Call Quality Analyzer (103), call quality at the device (102a), at periodic time intervals, by analyzing Real-time Transport Protocol (RTP) packets exchanged between the device (102a) and the at least one device (102b-102f);

comparing, by the CQA (103), the determined call quality with a predetermined call quality, wherein the predetermined call quality is set based on a desired Quality of Service (QoS) requirement; and

providing, by the CQA (103), a feedback of adequacy of the determined call quality to a VoIP Management Module (VMM) (101).
2. The method, as claimed in claim 1, wherein the method further comprises:

reporting, by the VMM (101), the determined call quality at the device (102a) to the at least one device (102b-102f);

performing, by the at least one device (102b-102f), at least one action, wherein the at least one action includes initiating the VoIP session with the device (102a) on a path providing a better call quality, re-establishing the VoIP session with the device (102a), and re-establishing the VoIP session with the device (102a) after a predefined time period.
3. The method, as claimed in claim 1, wherein the method further comprises:

determining, by the VMM (101), presence information of the device (102a), connected to the VMM (101) based on at least one metadata associated with the device (102a); and

broadcasting, by the VMM (101), the presence information of the device (102a) to at least one device (102b-102f) connected to the VMM (101).
4. The method, as claimed in claim 3, wherein the metadata associated with the device (102a) comprises: protocol used for signaling and controlling a VoIP session; availability of energy and/or radio resources for handling the VoIP session; and features supported for initiating a VoIP session.
5. The method, as claimed in claim 3, wherein the method further comprises transmitting to the at least one device (102b-102f), by the VMM (101), at least one of: the at least one

metadata associated with the device (102a), state of the device (102a), operating system used by the device (102a), and application using which the device (102a) is connected to the VoIP network (100).

6. The method, as claimed in claim 5, wherein the VMM (101) includes transmitting to the at least one device (102b-102f) based on an approval from the device (102a).

7. The method, as claimed in claim 3, wherein the method further comprises:

monitoring, by the VMM (101), at periodic time intervals, occurrence of at least one event, at the device (102a), leading to disconnection of the device (102a) from the VMM (101); and

broadcasting, by the VMM (101), an updated presence information of the device (102a) to the at least one device (102b-102f).

8. The method, as claimed in claim 7, wherein the at least one event occurring at the device (102a) comprises: switching to idle mode or doze mode from active mode, connecting to a different network, and disconnected from the VoIP session.