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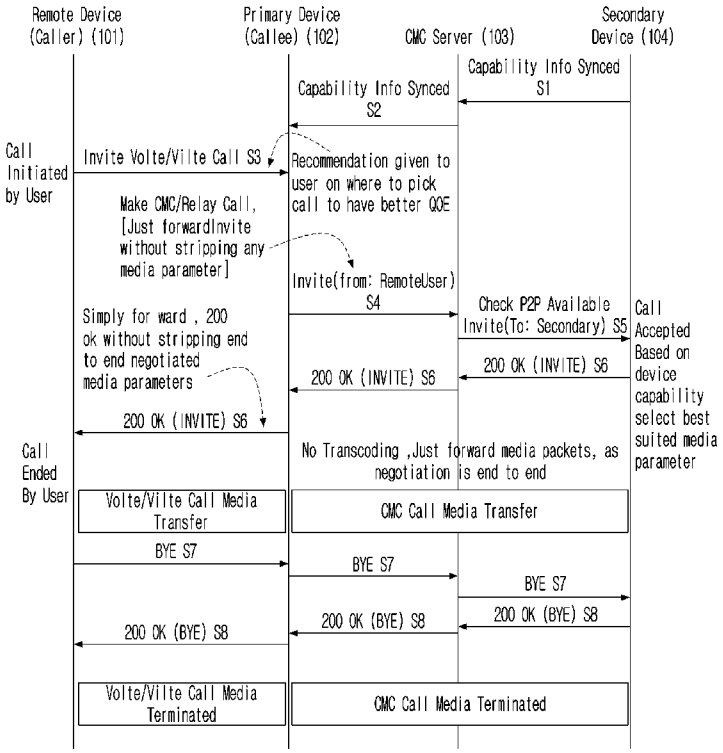
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(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.** [KR/KR]; 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677 (KR).

(72) Inventors: **KOLATI, Naveen**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **CHAKRABORTY, Prasenjit**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **SURANA, Ravi**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **KUMAR, Ashish**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **GUNDUR, Siva Prasad**; #2870, Phoenix Building, 4th Floor Bagmane Con-

(54) **Title:** MANAGING CALL AND MESSAGE CONTINUITY (CMC) SESSION



(57) **Abstract:** Accordingly, the embodiment herein is to provide method and device for managing CMC session between primary device (102) and secondary devices (104). The method includes receiving capability information of secondary devices (104) from CMC server (103) and receiving communication request message from remote device (101) to establish operator network session and CMC session with primary device (102), wherein communication request message comprises plurality of media parameters of remote device (101). Further, method includes determining optimal secondary device from secondary devices (104) based on capability information of each of secondary devices (104) and media parameters received from remote device (101) and establishing CMC session with optimal secondary device (104) by forwarding communication request message comprising media parameters to CMC server (103). Furthermore, method discloses receiving communication accept message from CMC server (103). Finally, facilitating media

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stellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **GOWNI RAMAKRISHNA, Venkatesh**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **SONI, Abhishek**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **Akshobhya**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **SAMAIYAR, Aranya**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **PANDEY, Rohit**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN). **DHOLARIYA, Dhruvil**; #2870, Phoenix Building, 4th Floor Bagmane Constellation Business Park, Outer Ring Rd, Doddanekundi, Marathahalli, Bengaluru, Karnataka 560037 (IN).

(74) **Agent: KIM, Tae-hun** et al.; 9th Floor, Shinduk Bldg., 343, Gangnam-daero, Seocho-gu, Seoul 06626 (KR).

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data transfer between remote device (101) and optimal secondary device (104).

Description

Title of Invention: MANAGING CALL AND MESSAGE CONTINUITY (CMC) SESSION

Technical Field

[1] This application is based on and derives the benefit of Indian Provisional Application 202341039095 filed on 07th June 2023, the contents of which are incorporated herein by reference. The present disclosure is related to wireless communication in electronic devices. More particularly the present disclosure is related to managing Call and Message Continuity (CMC) session between a primary device and secondary devices.

Background Art

[2] Nowadays the electronic devices having a feature of Call and Message Continuity (CMC) helps to continue messaging or calling from any device a user using. The CMC synchronizes calls and messages across the electronic devices. The CMC also includes call forking, call transfers, message synchronizing, and log synchronizing between the electronic devices. The CMC includes two types of electronic devices such as a primary device and secondary devices. The primary device generally have a SIM and it can initiates a multimedia communication between remote device and the primary device. Secondary device may or may not have SIM, but it will be connected to primary device via Wi-Fi or any local connection. When a secondary device initiates multimedia connection to the remote device via primary device, CMC session is established between the primary and secondary device, followed by operator network session being established between the primary and remote device. When a remote device initiates a multimedia communication to the primary device, a CMC session will also be established between the primary and all connected secondary devices.. The user can receive a call from the primary device or the secondary device. The user can also receive the call in the primary device and later switch to the secondary device to continue the call on the secondary device. Later, he can also switch back to primary from secondary device and continue call on primary device.

[3] Referring to FIG. 1, is a sequence diagram illustrating CMC flows. The primary device and the secondary device are used by one user. The secondary device may not communicate with the remote device directly. The secondary device may communicate with the remote device through the primary device. The caller device dials a number to connect to the primary device using a Session Initiation Protocol (SIP) invite message sent from the remote caller to the primary device, the invite message contains the capability details of remote caller device. The invite message received in the primary device and the primary device initiates a new invite towards the CMC server

based on capabilities of the primary device. CMC server determines all the available secondary devices and transfers the new invite to all the available secondary devices. An incoming call notification is shown in both the primary device and the available secondary devices. If the call or the communication request is accepted in the primary device, then single session is created that is one Volte/Vilte/Operator network session (101) between the remote device and the primary device (best suited media parameters supported by both remote and primary device are selected when sending 200 ok to remote device). If the call is accepted from the secondary device, then two sessions are created (102) and (103). First is the Volte/Vilte/Operator network session between the remote device and the primary device (based on the remote device and the primary device capability) (105). A second session is the CMC session between the primary device and the secondary device (based on the primary device and the secondary device capability) (106). When negotiated media parameters are different between the CMC session and the Volte/Vilte/Operator network session, then the primary device de-packetize, decode each Real-Time Transport Protocol (RTP) packets, then encode and packetize before forwarding to or from secondary devices, which increases power usage in primary device and overall end to end delay will also increase because of extra processing in primary device. When the call is ended by the remote or primary or secondary device, both the Volte and the CMC sessions are cleared and the user is notified on all the devices. The media parameters negotiation is performed between the primary device and the remote device, which is based on the capabilities of primary and remote. The negotiation between the secondary device and primary device happens based on capabilities of primary and secondary, even if the secondary device is more capable than the primary device, we cannot fully utilize those capabilities if primary device through which secondary device connected to remote is less capable. Therefore, there is a need for a method and a device to enhance the calling using capability aware CMC. Also, there is a need to enrich the CMC feature and provide better Quality of Experience (QoE) to users when using highly capable secondary devices.

Disclosure of Invention

Technical Problem

[4] The principal object of the embodiments herein is to provide methods and the devices for managing CMC session between a primary device and secondary devices. The CMC session is managed by establishing a communication between a primary device and a secondary device based on capability information.

[5] Another object of the embodiments herein is to receive capability information from secondary devices on demand or one time or periodic basis. Each secondary

device shares the associated media capabilities to primary device and the capability information can be used for negotiation and call recommendation.

[6] Another object of the embodiments herein is to negotiate media attributes based on end device capabilities (where the session is currently active). Based on end device where the call is accepted, new method of media parameters negotiation flows proposed to give the better quality of experience.

[7] Another object of the embodiments herein is to provide a recommendation of an optimal secondary device on which the quality of experience is better. A recommendation notification is displayed to the user on the primary device, recommending the optimal secondary device to receive the call.

[8] Another object of the embodiments herein is to provide renegotiation of media parameters between the electronic devices to maintain same media parameters in Volte and CMC session to avoid transcoding the media in primary device.

Solution to Problem

[9] A primary device for managing Call and Message Continuity (CMC) session, comprising a memory, a processor, a communicator and a CMC controller is communicatively coupled to the memory, the processor and the communicator is configured to receive capability information of a secondary device. For example, the primary device receives capability information of the secondary device directly or through a CMC server. The capability information may comprise media parameters of the secondary device, audio capabilities, video calling capabilities, haptic, text, sensor, 3D or 360 calling capabilities and the like.

[10] The CMC controller is configured to receive a communication request message from a remote device to establish an operator network session between the primary device and the remote device and CMC session between the primary device and the secondary device. The communication request message comprises a plurality of media parameters of the remote device.

[11] The CMC controller is configured to establish the operator network session with the remote device based on the capability information. The CMC controller is configured to establish the CMC session with the secondary device by forwarding the communication request message comprising the plurality of media parameters to the CMC server. For example, the operator network session may be formed based on optimal function among a plurality of functions supported by the secondary device. In this case, the primary device may not perform the transcoding of the media and may operate as the relay between the remote device and the secondary device.

[12] Accordingly, the embodiment herein is to provide a method for managing CMC session. The method includes receiving capability information of the plurality of

secondary devices and receiving a communication request message from a remote device to establish an operator network session between primary and remote, and CMC session between primary and secondary device, wherein the communication request message comprises a plurality of media parameters of the remote device. Further, the method includes determining an optimal secondary device from the plurality of secondary devices based on the capability information of each of the secondary devices and the plurality of media parameters received from the remote device and establishing the CMC session with the optimal secondary device by forwarding the communication request message comprising the plurality of media parameters to the CMC server. Furthermore, the method discloses receiving a communication accept message from the optimal secondary device via CMC server, wherein the communication accept message comprises at least one negotiated media parameter from the plurality of media parameters by the optimal secondary device for the CMC session and forwarding the communication accept message received from the CMC server to the primary and remote device. Finally, facilitating media data transfer between the remote device and the optimal secondary device via primary device.

[13] In an embodiment, the communication request message comprising the plurality of media parameters is forwarded to the optimal secondary device without stripping any of the media parameters received in the communication request message.

[14] In an embodiment, the communication accept message comprising the at least one negotiated media parameter is forwarded to the remote device without stripping any of the negotiated media parameter received in the communication accept message.

[15] In an embodiment, facilitating the media data transfer between the remote device and the optimal secondary device includes receiving media data packets from the remote device during the operator network session, wherein the media data packets are to be transmitted to the optimal secondary device and forwarding the media data packets received from the remote device to the optimal secondary device during the CMC session, wherein the media data packets are forwarded to the optimal secondary device without transcoding any of the media data packets by the primary device.

[16] In an embodiment, facilitating media data transfer between the remote device and the optimal secondary device includes receiving media data packets from the optimal secondary device during the CMC session, wherein the media data packets are to be transmitted to the remote device; and forwarding the media data packets received from the optimal secondary device to the remote device during the operator network session, wherein the media data packets are forwarded to the remote device without transcoding any of the data packets by the primary device.

[17] In an embodiment, detecting a trigger event associated with the optimal secondary device and transmitting a communication-pull notification message to the optimal

secondary device to pull. Further, terminating, by the primary device, the CMC session between the primary device and the optimal secondary device and renegotiating, by the primary device, the at least one optimal media parameter from the plurality of media parameters for the operator network session with the remote device based on the capability information of the primary device and continuing the media data transfer between the primary device and the remote device based on the at least one negotiated media parameter.

[18] In an embodiment, detecting a trigger event associated with the primary device and establishing the CMC session between the primary device and the optimal secondary device and renegotiating, by the secondary and primary device, the at least one optimal media parameter from the plurality of media parameters for the CMC session and the operator network session with the remote device based on the capability information of the at least one secondary device and continuing the media data transfer between the remote device and the secondary device based on the at least one negotiated media parameter.

[19] In an embodiment, the trigger event is at least one of a level of battery of the optimal secondary device meets a battery threshold, detecting that capability of the primary device is more than capability of the optimal secondary device, and a communication signal strength of the optimal secondary device meets a signal strength threshold, personal preference or choice of user.

[20] In an embodiment, the plurality of media parameters comprises codec, resolution, Frames per Second (FPS), sampling rate content information for the CMC and operator network session.

[21] Accordingly, embodiments disclosed herein is a method for receiving the communication request message including the media parameters from the remote device, and the communication request message received from the remote device is transmitted to the primary device and the primary device forwards the communication request as is to the secondary device via CMC server and negotiating optimal media parameter for the CMC session and the remote device based on the capability information of the optimal secondary device. Finally, transmitting the communication accept message to the CMS server, wherein the communication accept message includes negotiated media parameter.

[22] Accordingly, embodiments disclosed herein is a primary device for managing Call and Message Continuity (CMC) session, including a memory, a processor, a communicator, a CMC controller receives capability information of the plurality of secondary devices from a CMC server, receive a communication request message from a remote device to establish an operator network session with the primary device, wherein the communication request message comprises a plurality of media parameters

of the remote device and determine an optimal secondary device from the plurality of secondary devices based on the capability information of each of the secondary devices and the plurality of media parameters received from the remote device. Further, the primary device is configured to establish the CMC session with the optimal secondary device by forwarding the communication request message comprising the plurality of media parameters to the CMC server and receive a communication accept message from the optimal secondary device via CMC server, wherein the communication accept message comprises at least one negotiated media parameter from the plurality of media parameters by the optimal secondary device for the CMC session. The communication accept message received is forwarded by the primary device to the remote device and it facilitates media transfer between the remote device and the optimal secondary device via primary device.

[23] Accordingly, embodiments disclosed herein is a secondary device for managing CMC session, including a memory, a processor, a CMC receiver receives a communication request message comprising the media parameters from the CMC server, the communication request message received from a remote device is transmitted to a primary device and a primary device forwards the communication request as is to the secondary device via CMC server to negotiate optimal media parameter for the CMC session, here best possible media parameters are selected based on the remote device and optimal secondary device capability and transmit a communication accept message to the CMS server, and the communication accept message comprises negotiated media parameter.

[24] 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 preferred 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.

Advantageous Effects of Invention

[25] -

Brief Description of Drawings

[26] This method is illustrated in the accompanying drawings, throughout 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:

[27] FIG. 1 is a sequence diagram of a CMC flow, according to prior arts;

[28] FIG. 2 is a schematic representing a flow of a caller device establishing a communication session with the electronic device, according to prior arts;

[29] FIG. 3 is a schematic representing a flow of the caller device (102a) establishing the communication session with the primary device (102b), primary device (102b) establishing the communication session with secondary device(104) for enhanced calling using capability information, according to the embodiments herein;

[30] FIG. 4 is a sequence diagram illustrating the caller device or remote device (101) initiating the communication with end user based on the capability information of the various electronic devices, according to the embodiments herein;

[31] FIG. 5 is a schematic illustrating a number of sessions established between the caller device (101) and the end user or the electronic device and media flow between electronic devices according to the prior art;

[32] FIG. 6 is a schematic illustrating a number of sessions established between the caller device and the end user or the electronic device, and media flow between electronic devices, according to the embodiments herein;

[33] FIG. 7 is an example for a call initiation between two Video See through (VST) devices, according to prior arts;

[34] FIG. 8 is an example for a call initiation between the two VST devices, according to the embodiments herein;

[35] FIG. 9 is a flow diagram for managing the call and message continuity session between the primary device (102) and the secondary device (104), according to the embodiments herein;

[36] FIG. 10 is a sequence diagram illustrating an instance of receiving the call in the secondary device (104) and later pulled in the primary device (102), according to the embodiments herein;

[37] FIG. 11 is a sequence diagram illustrating an instance of receiving the call in the primary device (102) and later pulled in the secondary device (104), according to the embodiments herein;

[38] FIG. 12 is a sequence diagram illustrating an instance of 2D call between the electronic devices which are even capable of 360 degree or 3D call, according to the prior arts;

[39] FIG. 13 is a sequence diagram illustrating an instance of 2D call between the electronic devices, which are even capable of 360 degree or 3D call, according to the prior arts;

[40] FIG. 14 is a sequence diagram illustrating an instance of a 360 degree or 3D video call between the electronic devices based on capabilities synced with associated the primary device, according to the embodiments herein;

[41] FIG. 15 is a sequence diagram illustrating an instance of a call pull in a case of 360 degree or 3D video call between the electronic devices based on capabilities synced with associated the primary device, according to the embodiments herein;

[42] FIG. 16 is a block diagram illustrating a primary device for managing CMC session between the primary device and secondary devices, and operator network call between primary and remote device according to the embodiments herein; and

[43] FIG. 17 is a block diagram illustrating the secondary device for managing CMC session between the primary device and secondary devices, according to the embodiments herein.

Best Mode for Carrying out the Invention

[44] -

Mode for the Invention

[45] 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. Also, the various embodiments described herein are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments. The term “or” as used herein, refers to a non-exclusive or, unless otherwise indicated. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein can be practiced and to further enable those skilled in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

[46] As is traditional in the field, embodiments may be described and illustrated in terms of blocks which carry out a described function or functions. These blocks, which may be referred to herein as managers, units, modules, hardware components or the like, are physically implemented by analog and/or digital circuits such as logic gates, integrated circuits, microprocessors, microcontrollers, memory circuits, passive electronic components, active electronic components, optical components, hardwired circuits and the like, and may optionally be driven by firmware and software. The circuits may, for example, be embodied in one or more semiconductor chips, or on substrate supports such as printed circuit boards and the like. The circuits constituting a block may be implemented by dedicated hardware, or by a processor (e.g., one or more programmed microprocessors and associated circuitry), or by a combination of dedicated hardware to perform some functions of the block and a processor to perform other functions of the block. Each block of the embodiments may be physically separated into two

or more interacting and discrete blocks without departing from the scope of the disclosure. Likewise, the blocks of the embodiments may be physically combined into more complex blocks without departing from the scope of the disclosure.

[47] In an existing method, seamless movement of active media sessions between communication devices occurs. An application is used to facilitate switching of media session between the devices twinned therewith. In an aspect, a first device employing the application generates a request to switch a media session between a second device and a third device to be between the first device and a third device. The application sends the request to Call and Message Continuity (CMC) server. The request includes a first identifier for the first device, a second identifier for the second device and a device switch indicator. The request is configured to initiate a switch of the media session to being between the first device and the third device based on determination that the first device and the second device are associated with a common mobile subscriber identity registered for an account associated with the CMC server. The second device and the third device are the primary devices such as mobile phones and the first device can be laptops, palmtops, tablets, VST, watch and the like. However, the present disclosure discloses negotiating the media parameters based on end device capabilities (not dependent on intermediate device capabilities), when the call accepted or pulled on advanced device (such as VST/VR/AR/XR device).

[48] In an existing method, an accessory wireless device partakes in a data session with a remote device. The data session can be a voice call or other service. To preserve the battery power of the accessory wireless device, the accessory wireless device opportunistically offloads medium-to-long range radio transmission and reception tasks to the companion wireless device while maintaining call continuity. The accessory wireless device and the companion wireless device communicate through a local connection. The accessory wireless device pushes a wireless wide area network (WWAN) connection to the companion device by sharing selected security and network information with the companion wireless device. When the accessory device and/or the companion device determine that the local connection may not be sustainable, the accessory device pulls the WWAN connection of the companion device back to itself. Whereas the present disclosure provides a recommendation to the user, the optimal electronic device to receive the call. Also, the present disclosure provides solution for media quality improvement when the call is between the two advanced devices. Instead, the existing methods disclose offloading medium to long range wireless transmission and reception tasks to a second wireless device, while enjoying the utility of the accessory wireless device to save the battery in the accessory wireless device.

[49] The present disclosure includes receiving or transmitting capability information by a CMC server on demand or one time or periodic basis. Each secondary device shares the media capabilities to associated primary device through the CMC server and the capability information can be used for negotiation and call recommendation. Also, includes negotiating media attributes based on end device capabilities (end devices where the session is currently active). Based on the end device where the call is accepted, new method of media parameters negotiation flows proposed to give the better quality of experience. The end device can be the primary device or the secondary device, from which the call is accepted/initiated.

[50] The present disclosure includes a recommendation of an optimal electronic device on which the quality of experience (QoE) is better. A recommendation notification is displayed to the user on the primary device, recommending the optimal electronic device to receive the call.

[51] The present disclosure includes renegotiating the media parameters between the electronic devices to maintain same media parameters in Volte and CMC session without transcoding the media in primary device.

[52] FIG. 2 is a schematic representing a flow of a caller device establishing a communication session with the electronic device, according to prior arts. The schematic diagram includes hardware components such as a secondary device (104a & 104b), a primary device (102a & 102b), an operator server (202), and a CMC server (103). CMC system includes two types of devices. The primary device (102a) (ex: smartphone) and the secondary device (104a) (ex: AR/VR device) are used by User A. The secondary device (104a) may not communicate with the primary device (102b) or the secondary device (104b) directly. The secondary device (104a) may communicate with the primary device (102b) or the secondary device (104b) through the primary device (102a). The primary device (102b) (ex: smartphone) and the secondary device (104b) (ex: AR/VR device) are used by User B. The secondary device (104b) may not communicate with the primary device (102a) or the secondary device (104a) directly. The secondary device (104b) may communicate with the primary device (102a) or the secondary device (104a) through the primary device (102b). The first device can be the primary devices (102a & 102b) which generally have SIM and the second device which may have or may not have the SIM to initiate the call or to answer the all. In the existing methods, whenever a call is handled by the secondary devices (104a & 104b), even though the secondary devices (104a & 104b) are capable of better call experience (such as 360/3D call, spatial audio and the like) but it end up in not utilizing these capabilities if one of the primary devices (102a & 102b) with which it is connected has low capabilities (ex: supports only 2D call). This is because, media parameters negotiation happens based on the primary devices (102a & 102b) capability and not on

the basis of secondary devices (104a & 104b) capability where the session is currently active. The primary devices (102a & 102b) transcode, when negotiated parameters are different between VoLTE (session between the primary device and remote) and the CMC session (session between primary device and the secondary devices), this increases end to end delay and also increases power usage in the primary devices (102a & 102b).

[53] In an example, the secondary devices (104a & 104b) are capable of 3D/360 calling, but the primary devices (102a & 102b) are capable of only 2D calling. Therefore, the call established between the two secondary devices (104a & 104b) is a 2D call, even though the both secondary devices (104a & 104b) can support 3D/360 calling. This ends up affecting the user experience.

[54] In another instance, the secondary devices (104a & 104b) can be capable of High Definition (HD) calling, but the primary devices (102a & 102b) are capable of only Quarter Video Graphics Array (QVGA) calling. The call established between the secondary devices (104a & 104b) are QVGA call even though the secondary devices (104a & 104b) can support HD calling. The secondary devices (104a & 104b) can be capable of spatial audio calling, but the primary devices (102a & 102b) are capable of only mono audio calling. Therefore, the call established between secondary devices (104a & 104b) are mono audio call even though the secondary devices (104a & 104b) can support spatial audio calling.

[55] The secondary devices (104a & 104b) sometimes do not use Subscriber Identification module (SIM) and generally connected to the primary devices (102a & 102b) via Wi-Fi or ay local connection. When the call is between the secondary devices (104a & 104b) where both devices support 3D/360 calling, but the primary devices (102a & 102b) do not support 3D or 360 calling (the primary device only support 2D decoding and rendering). We end up negotiating only 2D parameters because, in the prior art final media parameter selected is the best/optimal common media parameter supported by all devices involved in call. The caller device can also have one of the secondary devices (104a & 104b), and the caller can initiate the call through one of the secondary devices (102a & 102b) to a callee. The caller device is a device that initiates the communication. The callee or a receiver device is a device that receives communication from the sender (caller).

[56] The secondary devices (104a & 104b) can be Virtual Reality (VR) device, Video See Through (VST), Augmented Reality (AR) glasses, Mixed Reality (MR) headsets, smartphones with AR capabilities, AR/VR accessories, AR/VR controllers and input devices, AR/VR camera devices, tablets and smart watches and the like. The secondary devices (104a & 104b) can be one and, in some cases, the secondary devices (104a &

104b) can include more than one. The caller device and the receiver device can be both the primary devices (102a & 102b) and the secondary devices (104a & 104b).

[57] The primary devices (102a & 102b) can be a user equipment such as smartphone. The operator server (202) can be the server that manages and controls operation in network such as routing requests, handling authentication, managing resources, and the like. The CMC server (103) maintains and manages session between primary and secondary device, it can store capability information of the secondary devices (104a & 104b), and this info will be synced with primary device one time/on periodic basis, which the primary devices (102a & 102b) can use for determining the optimal secondary devices (104a & 104b) for establishing the communication between the electronic devices. The communication happens between the secondary devices (104a & 104b) and the primary devices (102a & 102b) are via CMC server and the communication happens between the primary devices (102a & 102b) and remote is via the operator server.

[58] FIG. 3 is a schematic representing a flow of the caller device (102a) establishing the communication session with the primary device (102b) or secondary device (104b) for enhanced calling using capability information, according to the embodiments herein. The primary device (102a) (ex: smartphone) and the secondary device (104a) (ex: AR/VR device) are used by User A. The secondary device (104a) may not communicate with the primary device (102b) or the secondary device (104b) directly. The secondary device (104a) may communicate with the primary device (102b) or the secondary device (104b) through the primary device (102a). The primary device (102b) (ex: smartphone) and the secondary device (104b) (ex: AR/VR device) are used by User B. The secondary device (104b) may not communicate with the primary device (102a) or the secondary device (104a) directly. The secondary device (104b) may communicate with the primary device (102a) or the secondary device (104a) through the primary device (102b).

[59] The secondary devices (104a and 104b) can be Virtual Reality (VR) device, VST, Augmented Reality (AR) glasses, Mixed Reality (MR) headsets, smartphones with AR capabilities, AR/VR accessories, AR/VR controllers and input devices, AR/VR camera devices, tablets and smart watches and the like. The secondary devices (104a and 104b) can be one and, in some cases, it can include more than one. The caller device and the receiver device can be both the primary devices (102a and 102b) and the secondary devices (104a and 104b).

[60] The primary devices (102a and 102b) can be a user equipment such as smartphone. The operator server (202) can be the operator server (202) that manages and controls operation in network such as routing requests, handling authentication, managing resources, and the like. The CMC server (103) maintains and manages session between

primary and secondary device, it can store capability information of the secondary devices (104a and 104b), and this info will be synced with primary device one time/on periodic basis, which the primary devices (102a and 102b) can use it for determining the optimal secondary device for establishing the communication between the electronic devices. The communication happens between the secondary devices (104a and 104b) and the primary devices (102a and 102b) is via CMC server and the communication happens between the primary devices (102a and 102b) and remote is via the operator server (202).

[61] In an example, the secondary devices (104a and 104b) are capable of 3D/360 calling, but the primary devices (102a and 102b) are capable of only 2D calling. Therefore, the call established between the two secondary devices (104a and 104b) is a 3D/360 call, as only end device (two secondary devices) capabilities considered for negotiation of media parameters. This ends up improving the user experience.

[62] In another instance, the secondary devices (104a and 104b) can be capable of High Definition (HD) calling, but the primary devices (102a and 102b) are capable of only Quarter Video Graphics Array (QVGA) calling. The call established between the secondary devices (104a and 104b) is HD call, as only end device (secondary device) capabilities considered for negotiation of media parameters The secondary devices (104a and 104b) can be capable of spatial audio calling, but the primary devices (102a and 102b) are capable of only mono audio calling. Therefore, the call established between secondary devices (104a and 104b) are spatial audio call

[63] The present disclosure negotiates media parameters for the call based on the capability of respective end devices to improve QoE for the user. The remote device (101) initiates the call to the primary devices (102a and 102b). The remote device (101) can be a caller primary devices (102a and 102b) or a caller secondary device. Referring to the FIG. 3, the call is initiated between the caller device and the receiver device in the present disclosure can be 3D/360 call. The communication between remote and primary is performed using the operator server (202) and the communication between the secondary devices (104a to 104b) and the primary device (102a) is performed using the CMC server (103).

[64] FIG. 4 is a sequence diagram illustrating the caller device or remote device (101) initiating the communication with end user based on the capability information of the various electronic devices, according to the embodiments herein.

[65] Referring to FIG. 4, (at S3) remote device (101) or the caller device (101) initiates call to the primary device (102). The primary device (102) and all the connected secondary devices receive notification of a call. In an instance, the user accepts the call from the secondary device (104) (at the caller end). The call is established between the

secondary device (104) and the remote device (101) or the caller device (the primary device (102) can act as a relay).

[66] At S1 and S2, the CMC server (103) collects the capability information from the secondary device (104) and forwards it to primary device (102). The capability information may comprise media parameters of the devices, audio capabilities, video calling capabilities, haptic, text, sensor, 3D or 360 calling capabilities and the like. The capability information may comprise a plurality of functions provided by the secondary device (104). The capability information of secondary device is synced with the connected primary device (102). The connected primary device (102) is the device to which the secondary device is connected. The capability information can be synced on demand or one time basis or periodically. The capability information is collected by the CMC server (103) and stored. The capability information is also synced with the primary device (102) through the CMC server (103).

[67] At S3, the call is initiated by the remote device (101) or the caller device (101). The invite Volte/Vilte/IMS call is transmitted to the primary device (102). The primary device (102) also provides recommendation to the user. The recommendation can include optimal functions based on the capability information provided by the secondary device (104). The capability information may comprise media parameters of the devices, audio capabilities, video calling capabilities, haptic, text, sensor, 3D or 360 calling capabilities and the like. The capability information may comprise a plurality of functions provided by the secondary device (104).

[68] At S4, an invite is received in the primary device (102). The primary device (102) initiated a call or session using a SIP invite message. The SIP is a Session Initiation Protocol (SIP) is used for initiating and managing communication sessions. the primary device (102) forwards the invite which it received from remote device(101) to the CMC server(103) without striping any media parameters

[69] At S5, Point to Point (P2P) availability is checked at the CMC server (103). An extended invite is transmitted to available secondary devices from the CMC server (103).

[70] At S6, the primary device (102) forwards the response of secondary device (104) to the remote device (101) without striping any end to end negotiated media parameters. The response can be 200 OK. The 200 OK messages are part of the process of establishing a communication session. The secondary device selects and negotiate the best suited media parameter based on its own capability and the capability information received from the remote devices. The media parameters can be codec resolution, fps, sampling rate, and content information for the CMC and operator network session and the like. The media is flown between the caller device and the secondary device based on the negotiated capability information.

[71] The primary device (102) acts as a relay and do not decode/encode/depacketize/pa cketize/depacketize any media packets simply forward media packets from the remote device (101) to or from the secondary device.

[72] At S7, the call is ended by the remote device (101) or the caller device. When the call is ended by the remote user, both the Volte and the CMC session get cleared and the user is notified on all the devices.

[73] At S8, the call is ended message is accepted at the secondary device and the accept message is transmitted back to the remote device (101) via Primary device. The CMC call media is terminated between the secondary device and the primary device (102). The Volte/Vilte call media is terminated between the primary device (102) and the caller device.

[74] In the embodiments of the disclosure, in FIG. 5, it is explained that there is only one secondary device (104), but it is not limited to this. For example, the primary device (102) is connected to a plurality of secondary devices. The CMC server (103) collects the capability information from all the secondary devices and forwards it to primary device (102). The capability information can be media parameters of the devices, audio capabilities, video calling capabilities, haptic, text, sensor, 3D or 360 calling capabilities and the like. The capability information of all secondary devices is synced with the primary device (102). The capability information can be synced on demand or one time basis or periodically. The primary device (102) provides recommendation to the user optimal secondary device from among the plurality of secondary devices based on the capability information. The optimal secondary device can have a better Quality of Experience (QoE) compared to other secondary devices.

[75] FIG. 5 is a schematic illustrating a number of sessions established between the caller device (101) and the end user or the electronic device, it also shows how media flows between caller device(101) to the secondary device(104),according to the prior art. The schematic includes the remote device (101), the primary device (102), and the secondary device (104). The remote device (101) includes a camera (101a), an encoder (101b), RTP packetize (101c), and a socket (101d). The primary device (102) includes a display (102a), a camera (102i), a decoder (102c), an encoder (102d), an RTP depacketize (102e), and an RTP packetize (102f), and socket (102g). The secondary device (104) includes a display (104i), a decoder (104c), an RTP packetize (104c) and a socket (104d). The secondary device (104) is used for picking the call. The communication established between the primary device (102) and the remote device (101) is Volte/Vilte session (501) via operator server. The communication established between the secondary device (104) and the primary device (102) is the CMC session via CMC server (103). As negotiation is performed independently, different media parameter is negotiated and used in both the sessions.

[76] In the existing method, two sessions are established when the call is established between the remote device (101) and the secondary device (104). The remote device (101) transmits the media content to the primary device (102) based on media parameter negotiation. The primary device (102) receives data from the remote device (101) (on a UDP/RTP socket (101d to 102g). The primary device (102) removes RTP header called as depacketize (102e) and decode the data to get raw data using the decoder (102c) and then based on the CMC call negotiated media parameters, the raw data is encoded again using the encoder (102d). The encoded data is packetized using the RTP packetize (102f) and sent to the secondary device (104) over the CMC session (502). When the encryption is enabled and the primary device (102) encrypt RTP or RTCP packet (using the socket (102h) before forwarding it to the secondary device (104).

[77] The secondary device (104) receives the data from the primary device (102). The secondary device (104) depacketize (104c) and decode the data using the decoder (104c) received from the primary device (102). The decoded data is displayed on a User Interface (UI) (104a).

[78] The negotiation is hop to hop bases. One set of media parameters negotiated between the primary device (102) and the remote device (for example secondary device in this scenario). Another set of media parameters negotiated between the primary device (102) and the secondary device (104). As the media parameters negotiated in the CMC and Volte session independently, so there is high chance that negotiated media parameters are different between two media sessions so the primary device (102) is forced to transcode media data before forwarding the media to the secondary device in the CMC session.

[79] FIG. 6 is a schematic illustrating a media flow between remote, primary and secondary devices for the enhanced calling based on end device capability based negotiation, according to the embodiments herein. The schematic includes the remote device (101), the primary device (102), and the secondary device (104). The remote device (101) includes camera (101a), encoder (101b), RTP packetize (101c), and a socket (101d). The primary device (102) includes a display (102i), a camera (102j), a decoder (102c), the encoder (102d), an RTP depacketize (102e), and an RTP packetize (102f), and socket (102g). The secondary device (104) includes a display (104i), a decoder (104c), an RTP packetize (104c) and a socket (104d). The secondary device (104) is used for picking the call. The communication established between the primary device (102) and the remote device (101) is Volte/Vilte/IMS session (601) via operator server and the communication established between the secondary device (104) and the primary device (102) is the CMC session (602) via CMC server. In the present

disclosure, two sessions are established when the call is established between the remote device (101) and the secondary device (104).

[80] A first session is between the primary device (102) and the remote device (101). The first session can be the Volte/Vilte/IMS session. The CMC session (601) is established between the primary device (102) and the secondary device (104) based on the capability information. The primary device (102) knows the capability information of the secondary device (104) where the call is received, and that secondary device media parameters are used for re-negotiated with the remote device (101) to maintain same media attributes in both the sessions (Volte and CMC).

[81] The remote device (101) transmits the media content based on the secondary device (104) and the remote device media parameter renegotiation. The primary device (102) can receive the data from the remote device (101) (on UDP or RTP socket of Volte session). With less or no processing, the data is pushed to the CMC session using UDP socket (102g, 102h) (when the SRTP is enabled then the SRTP is encrypted before forwarding the data. The secondary device (104) receives the data from the primary device (102). The RTP depacketize (104c) the data received and decode (using decoder (102c)) the data to display on the UI (104a).

[82] The primary device (102), using re-negotiation method, will make sure that the operator network call and CMC call will have same media parameters for communication. In the existing method, two-independent session are negotiated. Therefore, transcoding is performed in the primary device (102) if negotiated parameters are different, but in the present disclosure re-negotiation method is used to maintain same media parameters in both call, so no transcoding is required in primary device.

[83] FIG. 7 is an example for a call initiation between two VST devices, according to prior arts. The VST is a remote secondary device (105) supporting 360 video, QVGA and HD resolution and audio can be both spatial and mono audio. A remote primary device (106) supports video: QVGA, and mono audio.

[84] The remote secondary device (105) when it tries to make a call to Primary device (102), a CMC call is initiated between remote secondary device (105) and the remote primary device (106), initiated call will have media parameters based on remote secondary device (105) capability, Ex: VST device (105) sends 360 video, QVGA and HD resolution for video and spatial and mono for audio. And then The remote primary device (106) initiates the operator based call, with the primary device (102), outgoing call will have media (audio, video etc..) parameters based on its own capability and capability it received from remote secondary device (105) (best possible common media parameters selected). Ex: in current scenario video: QVGA and mono audio sent as these are the possible common media parameters supported by both remote

device (105 & 106). Call rings on both Primary device (102). & all secondary device (104a and 104b), when the primary device (102). Sends call notification message to secondary devices it also sends media parameters based on own capability and capability it received from remote primary device (106) (best possible common media parameters selected), Ex : in current scenario video : QVGA and mono audio, the primary device (102) supports the QVGA resolution and the mono audio and it connected with the two secondary device (104a and 104b) The secondary device (104a) supports 360 video, QVGA/HD resolution and special, mono audio. The secondary device (104b) supports QVGA/HD resolution and the mono audio.

[85] If user picks call in secondary device (104a), then Call will be established between the two VST devices. The audio-mono and video-QVGA resolution is negotiated and used. The primary device (102 and 106) supports max QVGA and mono audio only (even though both VST supports HD video and spatial audio. The parameters are not negotiated or used because the primary device (102 and 106) is not supporting those parameters). If user picks call in secondary device (104b) then the call between the remote secondary device (105) and the secondary device (104b) (TAB Device) is negotiated with QVGA Resolution and the mono audio as the primary device (102, 106) supports max QVGA video resolution (even though tab (104b) and VST (105) support the HD video, and HD resolution is not selected or used because the primary device (102 and 106) do not support the HD video). As the CMC and Volte call negotiation is performed independently, the primary device (102 and 106) may need to transcode media, when negotiated parameters are different between the Volte and CMC Session. Even though end devices (the secondary devices (104a, 104b, 105) are highly capable. The capability information cannot be used to provide good QoE to the user as negotiation and usage of media parameters are restricted because of less capable primary device (102 and 106) through which they are connected to outside world.

[86] FIG. 8 is an example for a call initiation between the two VST devices, according to the embodiments herein. In VST call, user actual face is not visible (as user wear head mount device), so Avatar image of the user is used for video conversation. Here before initiating the call user can generate his avatar image and later use same image in call conversation. The VST is a remote secondary device (105) supporting 360 video QVGA, HD resolution and audio can be both spatial and mono audio. A remote primary device (106) supports QVGA resolution and mono audio.

[87] The remote secondary device (105) when it tries to make a call to Primary device (102), a CMC call is initiated between remote secondary device (105) and remote primary device (106). Initiated call will have media parameters based on remote secondary device (105) capability. Ex: VST device (105) sends 360 video, QVGA and

HD resolution for video and spatial and mono for audio. And then the remote primary device (106) initiates the operator based call with the primary device (102). outgoing call will have media (audio, video etc..) same as it received from Remote secondary device (105), i.e. remote primary device (102) will not add its own capability or it will not strip any media parameters which it won't support, it simply copies media parameters received from remote secondary device (105) and forwards it to The primary device (102), so in this example remote primary device (105) sends call invitation with 360 video, QVGA and HD resolution for video and spatial and mono for audio media parameters to primary device (102). Call rings on both Primary device (102). & all secondary device (104a and 104b).Primary device (102) supports the QVGA resolution and the mono audio and connected with the secondary device (104a and 104b). The secondary device (104a) supports 360 video, QVGA, HD resolution and special, mono audio. The secondary device (104b) supports QVGAHD resolution and the mono audio, when the primary device (102) sends call notification message to secondary devices it will not add its own capability or it will not strip any media parameters which it won't support, it simply copies media parameters received from remote primary device (106) and forwards it to secondary device (104a and 104b).

[88] If user picks call in secondary device (104a), then Call will be established between the two VST device (105, 104a) with spatial audio and 360 video parameters(best possible common media parameters selected),. If user picks call in secondary device (104b) then call between the VST device (105) and TAB device (104b) with mono audio and HD video resolution. In the present disclosure, negotiation is performed based on the end device capability information, and the primary device (102) acts as the relay (that is blind forwarding of received the packets), whose capabilities are not considered for negotiation, when the call is received in the secondary device (104b) which are highly capable than the primary device (102). Transcoding is skipped as same parameters are negotiated or maintained in both the CMC and Volte/Vilte call. The negotiation and usage of parameters is performed based on the end device capability information (two end points where call is active) not restricted based on the primary device (102,106) capability.

[89] The user can switch between the primary device (102) and the secondary device (104) in below cases:

[90] · User can pick/pull call on any device which is closer to the user.

[91] · If the primary device (102) is already used for some purpose, then the user can pick call from the secondary device (104) which is free (vice versa).

[92] · If the primary device (102) battery is low, then the user can pick call from the secondary device (104), which has more battery (vice versa).

[93] · If the primary display/memory/CPU/RAM capability is low compared to the secondary device (104), then the user can pick the call from the secondary device (104) for better QoE (vice versa).

[94] FIG. 9 is a flow diagram for managing the call and message continuity session between the primary device (102) and the secondary device (104), according to the embodiments herein.

[95] At 901, the primary device (102) receives the media capability information from the secondary device (104) on demand basis or periodic or one time during the device registration with the CMC server.

[96] At 902, the primary device (102) receives the incoming call notification from the remote device (106, 105).

[97] At 903, the primary device (102) transmits the notification to the secondary device (104) without stripping the media parameters.

[98] At 904, the primary device (102) is recommended on which device call need to be picked to have better QoE.

[99] At 905, determined whether the call is accepted and when the call is accepted in the secondary device (at 906).

[100] At 907, the media parameters are negotiated based on the secondary device (104) and the remote device (106, 105) capability and same media parameters maintained in the Vilte and CMC session.

[101] At 908, the primary device (102) acts as the relay, with no or less processing of media content and transfer the media content to/from the secondary device (104) to the remote device (106).

[102] At 909, when the call is pulled from the primary device (102), media session is terminated between the primary device (102) and the secondary device (104) (at 910).

[103] the media session between the primary device (102) and the secondary device (104) is terminated, and the call is pulled from the primary device (102), then the media parameters are negotiated based on the primary device (102) and the remote device (101, 105) capability information (at 911).

[104] At 911, media parameters are re-negotiated based on the primary device (102) and the remote device (106,105) capability information (such as Vilte/Volte).

[105] At 912, the media parameters flow between the remote device (106/105) and the primary device (102) based on the re-negotiated media parameters.

[106] At 913, when the call is pulled from the secondary device (104), then the CMC media session is initiated between the primary device (102) and the secondary device (104). When the call is not pulled from the secondary device (104) then again media flows between the remote device (106) and the primary device (102) until the call is pulled from the secondary device.

[107] When call is pulled from the secondary device (104)CMC media session is initiated between the primary device (102) and the secondary device (104), and the media parameters are re-negotiated based on the secondary device (104) and the remote device (105,106) capability information and same media parameters are maintained in the Vilte and CMC session (at 907).

[108] FIG. 10 is a sequence diagram illustrating an instance of receiving the call in the secondary device (104) and later pulled in the primary device (102), according to the embodiments herein.

[109] Referring to FIG. 10, secondary devices (104) capability information synched with primary device (102) via CMC server on demand basis or periodic or one time during the device registration with the CMC server, the remote device (101) or the caller device (102) initiates call to the primary device (102). The receiver devices (102, 104) receives notification of the call on the primary device (102) and all the connected secondary devices (104). The primary device (102) receives additional notification on the recommendation of the optimal secondary device (104) where the call can be picked to have better quality of experience. In an instance, the user accepts the call from the secondary device (104) (at the receiver end). The call is established between the secondary device (104) and the remote device or the caller device (101) (the primary device (102) can act as a relay).

[110] At S1 and S2, the CMC server (103) collect the capability information from all the secondary devices (104). The capability information can be media parameters of the devices, audio capabilities, video calling capabilities, haptic, text, sensor, 3D or 360 calling capabilities and the like. The capability information of all the devices is synced with the connected primary device (102). The connected primary device (102) is the device to which all the secondary devices (104) are connected (it's the device whose credentials are used in all secondary device for connecting to common network). The capability information can be synced on demand or periodic or on time basis. The time basis is the time stamp at which the capability information is transmitted. The capability information is collected by the CMC server (103) and stored. The capability information is also synced with the primary device (102) through the CMC server (103).

[111] At S3, the call is initiated by the remote device (101) or the caller device (101). The invite Volte/Vilte call is transmitted to the primary device (102). The primary device (102) also provides recommendation to the user. The recommendation can include the optimal secondary device (104) (recommended device) on which the user receives the call. The recommended device can include a better Quality of Experience (QoE) compared to available devices. The recommended device can be the primary device (102), secondary device (104).

[112] At S4, an invite is received in the primary device (102), the primary device (102) initiate new CMC call to all connected secondary devices (104) by sending SIP invite message by copying all media parameters (i.e. without stripping/modifying any of the parameters)which it received from remote device, The SIP is used to initiate and manage communication sessions.

[113] At S5, Point to Point (P2P) availability is checked at the CMC server (103). The extended invite is transmitted to available secondary devices from the CMC server (103).

[114] At S6, secondary device (104) accept the call based on the recommendation and then forwards acceptance notification to primary device (102), later the primary device (102) forwards the invite to the remote device (101) without striping end to end negotiated media parameters. The invite can be 200 OK. The 200 OK messages are part of the process of establishing a communication session. The secondary device (104) selects the best suited media parameter based on the capability information received from the remote device devices and from its own capability. The media parameters can be codec resolution, fps, sampling rate, and content information for the CMC and operator network session and the like. The media is flown between the caller device (101) and the secondary device (104) based on the negotiated parameters.

[115] The primary device (102) acts as a relay and do not decode/encode/depacketize/pa cketize/depacketize any media packets simply forward media packets from the remote device (101) to or from the secondary device (104).

[116] At S7, Call is pulled in primary device (102) from secondary device, a new invite message is sent to remote device (101) from primary device and existing CMC session between secondary device (104) and primary device (102) is terminated. Here media parameters re-negotiated based on primary device (102) and remote device (101) capability, media also flow between primary and remote device based on negotiated media parameters, here for re-negotiation SIP re-invite /update method can be used.

[117] The call is ended by the remote device (101) or the caller device (101). When the call is ended by the remote user, both the Volte and the CMC session get cleared and the user is notified on all the devices.

[118] The secondary device (104) capabilities synced with connected primary device (102) (On demand/periodic/One time basis). The primary device's (102) number is dialled and call made from the remote device (101), the SIP invite message sent from the remote device (101) to the primary device (102)). The invite received in the primary device (102), recommendation given to the user on the primary device (102), on which device user need to pick the call to have better QOE. The primary device (102) without stripping any media parameters from received invite, simply forwards the media parameters to the secondary device (104) via CMC server. The

call rings on the secondary device (104) and user picks up the call on the secondary device (104). The secondary device (104) selects best suited media parameter based on device capability and sends 200 OK with that info. The primary device (102) simply forwards 200 OK without stripping any media parameters. The media flows between the remote device (101) and the secondary device (104). The primary device (102) acts as relay, decode/encode/depacketize/packetize ay media packets, simply forward media packets from remote to/from to secondary. At S7, Call is pulled in primary device (102) from secondary device, a new invite message is sent to remote device (101) from primary device and existing CMC session between secondary device (104) and primary device (102) is terminated. Here media parameters are re-negotiated based on primary device (102) and remote device (101) capability, media also flow between primary and remote device based on negotiated media parameters. At S8, the remote device (101) establishes the modified connection with the primary device (102) with the invite message and the Volte/Vilte call media is transmitted based on re-negotiated media information once the communication is accepted. The CMC call media is terminated between the secondary device (104) and the primary device (102).

[119] Few example reasons on why user pick call on secondary device rather than primary device are the user is close to the secondary device (104) (or the user can find the secondary device more easily than the primary device (102)). The primary device (102) battery is low (when the display is active for more duration, then the battery drains faster). The secondary device (104) has more capability (Display/CPU/RAM) than the primary device (102). The call is for other family member, who can pick call from the secondary device (104) without disturbing the user activity in the primary device (102).

[120] FIG. 11 is a sequence diagram illustrating an instance of receiving the call in the primary device (102) and later pulled in the secondary device (104), according to the embodiments herein.

[121] The receiver device (102, 104) receives notification of the call on the primary device (102) and all the connected secondary devices (104). The primary device (102) receives additional notification on the recommendation of the optimal secondary device (104). In an instance, the user accepts the call from the primary device (at the receiver end). The call is established between the primary device and the remote device (101) or the caller device

[122] At S1 and S2, the CMC server (103) collect the capability information from all the secondary devices (104). The capability information can be the media parameters of the devices, audio capabilities, video calling capabilities, haptic, text, sensor, 3D or 360 calling capabilities and the like. The capability information of all the devices is synced with the connected primary device (102). The connected primary device is the

device to which all the secondary devices (104) are connected (it's the device whose credentials are used in all secondary device for connecting to common network). The capability information can be synced on demand or periodic or on time basis. The time basis is the time stamp at which the capability information is transmitted. The capability information is collected by the CMC server (103) and stored. The capability information is also synced with the primary device (102) through the CMC server (103).

[123] At S3, the call is initiated by the remote device (101) or the caller device (101). The invite Volte/Vilte call is transmitted to the primary device (102). The primary device (102) also provides recommendation to the user. The recommendation can include the optimal secondary device (104) (recommended device) on which the user receives the call. The recommended device can include a better Quality of Experience (QoE) compared to available devices.

[124] At S4, the invite is received in the primary device (102), the primary device (102) initiate new CMC call to all connected secondary devices(104) by sending SIP invite message, it copies all media parameters (i.e., without stripping/modifying any of the parameters)which it received from remote device. The SIP is used to initiate and manage communication sessions.

[125] At S5, Point to Point (P2P) availability is checked at the CMC server (103). The secondary or extended invite is transmitted to available secondary devices from the CMC server (103).

[126] At S6, call is accepted in the primary device (102), the primary device (102) forwards the accepted response back to the remote device (101) without striping end to end negotiated media parameters. The response can be 200 OK. The 200 OK messages are part of the process of establishing a communication session. The primary device (102) selects the best suited media parameter based on the capability information received from remote device devices and from its own capability's. The media parameters can be codec resolution, fps, sampling rate, and content information for the CMC and operator network session and the like. The media is flown between the caller device and the primary device based on the negotiated capability information.

[127] After sometime call is pulled from Secondary device (104), a new CMC call is established between Secondary device (104) and primary device (102), here the media parameters are re-negotiated based on remote device (101) and secondary device (104) capability. And re-negotiation of media parameters also happen between primary(102) and remote device in operator network call based on secondary (104) and remote device (101) capability, here for re-negotiation SIP re-invite /update method can be used

[128] The primary device (102) acts as a relay and do not decode/encode/depacketize/packetize/depacketize any media packets simply forward media packets from the remote device (101) to or from the secondary device (104).

[129] The secondary device (104) capabilities synced with the connected primary device (102) (On demand/Periodic/One time basis). The primary device's (102) number is dialled and the call made from the remote device (101) (SIP invite message sent from the remote device to the primary device). The invite is received in the primary device (102), and recommendation given to the user on the primary device (102), on which the device user need to pick the call to have better QoE, call is accepted in the primary device (102) The primary device (102) selects the best suited media parameter based on the capability information received from remote device devices and from its own capability and sends selected media parameter information in 200OK, media flow between primary device (102) and remote device (101). After sometime call is pulled from Secondary device (104), a new CMC call is established between Secondary device (104) and primary device (102), here media parameters are negotiated based on remote device(101) and secondary device (104) capability here The media flows between the remote device (101) and the secondary device (104).

[130] The primary device (102) just as relay, do not decode/encode/depacketize/packetize any media packets, simply forward media packets from the remote to/from the secondary device (104). The user pulled the call from the primary device (102) and the primary device (102) re-negotiate the media parameters with the remote device (101), when found new media parameter better suited than old parameter, which is currently in use. The media session is terminated between the primary device (102) and the secondary device (104). The media transmission/reception is performed between the remote device (101) and the primary device (102) based on the new negotiation. The device because of one of the below reason:

[131] · The secondary device battery low.

[132] · The primary device (102) has more capability (Display/CPU/RAM) than the secondary.

[133] · The Wi-Fi strength is weak in the secondary device.

[134] In these cases, re-invite/update triggered from the primary device (102) to re-negotiate media parameters between the primary device (102) and the remote device (101).

[135] The secondary device capability information are synced with the connected primary device (102) (on demand/periodic/on time basis). The primary device's (102) number is dialled and the call is made from the remote device (SIP invite message sent from the remote device (101) to the primary device (102). The invite is received in the primary device (102), recommendation given to the user on the primary device

(102), on which the user need to pick the call to have the better QoE. The primary device (102) without stripping any media parameters from the received invite, simply forwards to the secondary device (104). The call rings on the secondary device (104) and as well as on the primary device (102). The user is ignored recommendation and receives the call in the primary device (102). The primary device (102) negotiates, media parameters with the remote device (101) based on the media capabilities of primary and remote device. The media flows between the remote device (101) and the primary device (102) based on the negotiated media parameters.

[136] The user pulls the call from the secondary device (104). The call pull information is notified to the primary device (102). The primary device (102) re-negotiate media parameters with the remote device (101) and the secondary device (104), based on the secondary device (104) and the remote device capability. The media flows between the remote device (101) and the secondary device (104) based on the new media parameter negotiation. The primary device (102) acts as relay, and do not decode/ encode/depacketize/packetize any media packets, simply forward media packets from the remote to/from the secondary device (104).

[137] The user initially accepted call in the primary device (102) (as the user is closer to the primary device) later the user pull call in the secondary device because of one of the below reasons:

[138] · The primary device (102) battery is low (if the display is active for more duration, then it will drain faster).

[139] · The secondary device (104) includes more capability information (Display/CPU/ RAM) than the primary device (102).

[140] · The call is for other family member, who can pick the call from the secondary device (104) without disturbing user activity in the primary device (102).

[141] In this case, re-invite/update triggered from the primary device (102) to re-negotiate media parameters between the primary device (102) and the remote device (101).

[142] The QoE for the user is improved as the call is established based on end device capability (not dependent on intermediate device). Effective usage of secondary device capability (Like VST, VR/AR device). End to End delay & power usage is reduced as no extra processing in the primary device (102). The user guided on which device to pick to have better experience, which improves overall quality of service in the CMC. The CMC feature usage increase as feature can be extended to all advance device.

[143] Secondary device (104) needs to sync their media capability with connected/ associated primary device (102). Secondary device (104) capability sync can happen in 3 ways:

[144] 1. One Time -> As soon as secondary device (104) registers with CMC server, its media capability info will be synced with primary device (102) via CMC server

[145] 2. On Demand -> If Primary device (102) finds capability of secondary device (104) which it received earlier is corrupt or not complete then it can query and get media capability info from secondary device (104)

[146] 3. Periodic -> Secondary device periodically (like one in 10 min or 1 hour) sync media capability info with primary device (102) via CMC server

[147] Syncing the media capability will help primary device (102) in below ways:

[148] · As soon as incoming invite is received, based on secondary device (104) capability it has, it can recommend in which device call need to be picked up to have better QOE

[149] · It can decide if media parameters in invite/update message need to be stripped or retained, before forwarding invite/update message to secondary

[150] · In call pull scenario, as it already has secondary device (104) capability information, it will help in negotiating new media parameters with remote device (101).

[151] In CMC, Json format is already used to sync contact and message details from secondary device to primary device. Information shared as Name and Value pair: for instance:

[152] ‘9-02 15:08:55.804 6878 9472 I [NMS2]VolleyCntlr: [0057](=>)

[153] PostRequest={"object":{"correlationTag":"8d23b0223d218ffa","flags":{

[154] "flag":["/Seen"]},"attributes":{"attribute":[{"name":"Call-

[155] Disposition","value":["OUTGOING"]},{"name":"Call-

[156] DispositionExt","value":["2"]},{"name":"Call-

[157] Duration","value":["29"]},{"name":"Call-

[158] Type","value":["volte"]},{"name":"Call-

[159] TypeExt","value":["1000"]},{"name":"Date","value":["2022-09-

[160] 02T06:08:21.761Z"]},{"name":"Device-

[161] Name","value":["d75f03603652443e31b44bc11714211a97f71a197b835

[162] 0b8eff4b49a8c1bd98b"]},{"name":"Direction","value":["OUT"]},{"nam

[163] e":"Emergency","value":["false"]},{"name":"From","value":["+8210577

[164] 24901"]},{"name":"Message-Context","value":["x-call-

[165] log"]},{"name":"Presentation","value":["1"]},{"name":"Sim_id","value"

[166] :["1"]},{"name":"To","value":["01033903474"]}]}}}’

[167] For media capability sync the method is extended (that is capability info shared using Json format as Name, Value Pair)

[168] For example: when the secondary device (104) supports 720p video resolution and EVS audio codec, then json content can be below:

[169] ‘PostRequest={"object":{"MediaCapability":"8d23b0223d218ffa"},"attri

[170] butes":{"attribute":[{"name":"Video_Width","value":["720"]},{"name":"

[171] Video_Height","value":["1280“]},

[172] {"name":"Video_FPS","value":["30"]},{"name":"Video_Codec","value":

[173] ["H265"]},{"name":"Audio_Codec","value":["EVS"]}]}}'

[174] FIG. 12 is a sequence diagram illustrating an instance of a 360 degree or 3D video call between the electronic devices, according to the prior arts.

[175] At S1, the device A and device D (caller secondary device and the callee secondary device) can be VST/AR/VR device which supports 2D and 360 kind of decoding and rendering. The device B and device C (caller primary device (102) and the callee primary device) includes mobile device with the SIM, which supports only 2D decoding and rendering. The user initiates the call from the device A (VST) to device C. The call ringing in both the devices C and D, as the device C and D are connected.

[176] At S2, S3 and S4, the user decides to receive the call from the device D (VST). The 2D parameters are negotiated, as the device B, before sending the invite to device C strips 3D/360 media parameters as the device B do not support the 3D/360 media parameters.

[177] 2D media flow between device A (VST) and Device D (VST) the call ends and new call is initiated from the device A to device C. This time, the user receives the call from device C and 2D Parameters get negotiated.

[178] At S5, the device is capable of decoding and rendering 360 and 2D media parameters makes the call to either device C or device D and always ends up negotiating the 2D media parameters (for transmission, reception and rendering). At S6 and S7, even though device A and device D is capable of the 360-video decoding and rendering, the capabilities are not used to provide the better QoE to the user.

[179] FIG. 13 is a sequence diagram illustrating an instance of the call pull in a case of 360 degree or 3D video call between the electronic devices, according to the prior arts.

[180] At S1, the device A and device D (Secondary Devices) can be VST/AR/VR device which supports 2D and 360 decoding and rendering. The device B and device C (Primary Device) includes mobile device with SIM, which supports only 2D decoding and rendering. The user makes a call from device A (VST) to device C and the call ringing in both device C and device D as both are connected.

[181] At S2, the user decided to pick the call from device C. At S3, the 2D parameters are negotiated, as device B, before sending invite to the device C strips 3D/360 media parameters as device B do not support it.

[182] At S5 and S6, after some time, user decides to receive the call from device D (pull call from device C). Again, the 2D media parameters negotiated even though A and D both support 360 video decoding and rendering.

[183] FIG. 14 is a sequence diagram illustrating an instance of a 360 degree or 3D video call between the electronic devices based on capabilities synced with associated the primary device (102), according to the embodiments herein.

[184] At S1-S2, the secondary device (104) capabilities are synced with associated with the primary device (102) (device D with device C & device A with device B).

[185] At S3-S4, the user makes the call from device A (105) (VST) to device C (102). The call ringing in both device C (102) and device D (104) as both are connected, and recommendation given to the user to pick the call from device D (104) to have better QoE. Based on the recommendation, the user decides to receive call from the device D (104) (VST).

[186] At S5, the 3D/360 parameters are negotiated, this is because Device B or Device C will not strip any media parameters even though they don't support it, device A (105) and device D (104) conversation happens with the 3D/360 media parameters, device B and device C acts as relay, simply forwards packets to the device A and device D with very less or zero processing.

[187] At S6, the call ends and new call is initiated from device A to device C. The user ignored recommendation and receives call from device C (102) and 2D parameters are negotiated for transmission and reception.

[188] At S7, using above method, the capabilities are fully utilized provided by VST or any advanced AR/VR/XR devices to give better quality of experience to user.

[189] At S5-S6-trigger Point: the user can receive call in the device D (104) because of one of the below reasons (few examples):

[190] 1. the user is close to the device D (104) (or user can find device D (104) more easily than the device c (primary device) (102)).

[191] 2. the device c (primary device) (102) battery is low (when the display is active for more duration than the battery drained faster).

[192] 3. the device D (secondary device) (104) has more capability (Display/CPU/RAM) than the primary device (102).

[193] 4. the call is for other family member, who can pick call from the device D (104) (secondary device) without disturbing user activity in the primary device (102).

[194] The user can receive the call in the device C (102) (Trigger point for S10 & S11) primary device because of one of the below reasons (few examples):

[195] 1. The device D (104) (secondary device) battery is low

[196] 2. Primary device (102) has more capability (Display/CPU/RAM) than secondary

[197] 3. Wi-Fi strength is weak in the device D (secondary device (104)).

[198] FIG. 15 is a sequence diagram illustrating an instance of a call pull in a case of 360 degree or 3D video call between the electronic devices based on capabilities synced with associated the primary device (102), according to the embodiments herein.

[199] At S1-S2, the secondary device (104) capabilities synced with correspond primary device (102) (device D with device C and device A with device B). The user makes the call from device A (VST) to device C. At S3 and S4, the call is ringing in both device

C and device D as both are connected, the recommendation given to the user to receive the call from device D to have better QoE. Initially the user decided to receive call from the device C.

[200] At S5-S6, the 2D parameters negotiated for transmission and reception. After some time, user decides to receive the call from device D (pull call from device C). The 3D/360 parameters renegotiated, and device A and device D conversation is performed with the 3D/360 media parameters (device B and device C acts as relay, simply forwards packets to the secondary device). Here, when the call is between the device A and device D (2 VST device), the capability is fully utilized to give better QoE.

[201] At S4-S5, the user accepts the call in the primary device (102) (as the primary device (102) is closer to the user) later he pulled the call in the secondary device because of one of the below reasons (few examples):

[202] 1. The primary device (102) battery is low (when the display is active for more duration, then the battery is drained faster).

[203] 2. The secondary device have more capability (Display/CPU/RAM) than the primary device (102).

[204] 3. The call is for other family members, who can pick call from secondary device without disturbing the user activity in the primary device (102).

[205] 4. The primary device (102) is needed for some other purpose (like Kid/spouse need it) and secondary device is free.

[206] The present disclosure includes a recommendation of an optimal electronic device on which the quality of experience (QoE) is better. A recommendation notification is displayed to the user on the primary device (102), recommending the optimal electronic device to receive the call.

[207] FIG. 16 is a block diagram illustrating a primary device (102) for managing CMC session between the primary device (102) and secondary devices (104), according to the embodiments herein.

[208] The primary device (102) includes a memory (1601), a processor (1602), a communicator (1603), and a CMC and operation session controller (1604).

[209] The memory (1601) is configured to store instructions to be executed by the processor (1602). The memory (1601) can include non-volatile storage elements. Examples of such non-volatile storage elements may include magnetic hard discs, optical discs, floppy discs, flash memories, or forms of electrically programmable memories (EPROM) or electrically erasable and programmable (EEPROM) memories. In addition, the memory (1601) may, in some examples, be considered a non-transitory storage medium. The term “non-transitory” may indicate that the storage medium is not embodied in a carrier wave or a propagated signal. However, the term “non-transitory” should not be interpreted that the memory (1601) is non-movable. In some

examples, the memory (1601) is configured to store larger amounts of information. In certain examples, a non-transitory storage medium may store data that can, over time, change (e.g., in Random Access Memory (RAM) or cache).

[210] The processor (1602) may include one or a plurality of processors. The one or the plurality of processors may be a general-purpose processor, such as a central processing unit (CPU), an application processor (AP), or the like, a graphics-only processing unit such as a graphics processing unit (GPU), a visual processing unit (VPU), and/or an AI-dedicated processor (1602) such as a neural processing unit (NPU). The processor (1602) may include multiple cores and is configured to execute the instructions stored in the memory (1601).

[211] The communicator (1603) includes an electronic circuit specific to a standard that enables wired or wireless communication. The communicator (1603) is configured to communicate internally between internal hardware components such as for example the memory (1601), the processor (1602), the CMC and operation session controller (1604) and with external devices via one or more networks.

[212] The CMC and operation session controller (1604) receives and stores media capability information received from all connected secondary devices, it determines the optimal secondary device based on the capability information and the media parameters received from the remote device (101) and Capability information of secondary devices to establish the CMC session with the optimal secondary device. In an embodiment, the optimal secondary device can be determined based on a user input. For example, a user interface or a notification or pop up can be displayed on the primary device (102) to select the optimal secondary device.

[213] The CMC and operation session controller is responsible for starting and ending CMC and IMS based (operator network based) session based on user action and it can also modifying or re-negotiate media parameters of both session (CMC and operator network) based on end device capabilities. The CMC and operation session controller (1604) receives the communication accept message from the CMC server, and the communication accept message includes negotiated media parameter. The communication request message includes the media parameters that is forwarded to the optimal secondary device without stripping any of the media parameters received in the communication request message. The communication accept message includes negotiated media parameter forwarded to the remote device (101) without stripping any of the at least one negotiated media parameter received in the communication accept message. The CMC and operation session controller (1604) facilitates the media data transfer between the remote device (101) and the optimal secondary device.

[214] FIG. 17 is a block diagram illustrating the secondary device (104) for managing CMC session between the primary device (102) and secondary devices (104), according to the embodiments herein.

[215] The secondary device (104) includes a memory (1701), a processor (1702), a communicator (1703), and a CMC session controller (1704).

[216] The memory (1701) is configured to store instructions to be executed by the processor (1702). The memory (1701) can include non-volatile storage elements. Examples of such non-volatile storage elements may include magnetic hard discs, optical discs, floppy discs, flash memories, or forms of electrically programmable memories (EPROM) or electrically erasable and programmable (EEPROM) memories. In addition, the memory (1701) may, in some examples, be considered a non-transitory storage medium. The term "non-transitory" may indicate that the storage medium is not embodied in a carrier wave or a propagated signal. However, the term "non-transitory" should not be interpreted that the memory (1701) is non-movable. In some examples, the memory (1701) is configured to store larger amounts of information. In certain examples, a non-transitory storage medium may store data that can, over time, change (e.g., in Random Access Memory (RAM) or cache).

[217] The processor (1702) may include one or a plurality of processors. The one or the plurality of processors may be a general-purpose processor, such as a central processing unit (CPU), an application processor (AP), or the like, a graphics-only processing unit such as a graphics processing unit (GPU), a visual processing unit (VPU), and/or an AI-dedicated processor (1702) such as a neural processing unit (NPU). The processor (1702) may include multiple cores and is configured to execute the instructions stored in the memory (1701).

[218] The communicator (1703) includes an electronic circuit specific to a standard that enables wired or wireless communication. The communicator (1703) is configured to communicate internally between internal hardware components such as for example the memory (1701), the processor (1702), the CMC controller (1704) and with external devices via one or more networks.

[219] The CMC session controller (1704) sends media capability information of all connected secondary devices to primary device via CMC server, The CMC session controller (1704) receives the communication request message from the CMC server, and the communication request message includes media parameter of remote device. It also sends accept message to primary device via CMC server, the communication request message includes negotiated media parameter which are selected based on remote and secondary device capability. The CMC session controller (1704) facilitates the media data transfer between the primary device and the optimal secondary device. The CMC controller is responsible for starting and ending CMC session between

primary and secondary device, and it can also modifying or re-negotiate media parameters of CMC session based on end device capabilities.

[220] 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

[Claim 1] A primary device (102) for managing Call and Message Continuity (CMC) session, comprising:
a memory (1601);
a processor (1602);
a communicator (1603); and
a CMC controller is communicatively coupled to the memory, the processor and the communicator (1603) is configured to;
receive, capability information of a plurality of secondary devices (104) from a CMC server (103);
receive a communication request message from a remote device (101) to establish an operator network session and the CMC session with the primary device (102), wherein the communication request message comprises a plurality of media parameters of the remote device (101);
determine an optimal secondary device (104) from the plurality of secondary devices (104) based on the capability information of each of the secondary devices (104) and the plurality of media parameters received from the remote device (101);
establish the CMC session with the optimal secondary device (104) by forwarding the communication request message comprising the plurality of media parameters to the CMC server (103);
receive a communication accept message from the CMC server (103), wherein the communication accept message comprises at least one negotiated media parameter from the plurality of media parameters by the optimal secondary device (104) for the CMC session;
forward the communication accept message received from the CMC server (103) to the remote device (101); and
facilitate a media data transfer between the remote device (101) and the optimal secondary device (104).

[Claim 2] The primary device (102) as claimed in claim 1, wherein the communication request message comprising the plurality of media parameters is forwarded to the optimal secondary device (104) without stripping any of the media parameters received in the communication request message.

[Claim 3] The primary device (102) as claimed in claim 1, wherein the communication accept message comprising the at least one negotiated media parameter is forwarded to the remote device (101) without stripping any of the at least one negotiated media parameter received in the communication accept message.

[Claim 4] The primary device (102) as claimed in claim 1, facilitate the media data transfer between the remote device (101) and the optimal secondary device (104) comprises:
receive media data packets from the remote device (101) during the operator network session, wherein the media data packets are to be transmitted to the optimal secondary device (104); and
forward the media data packets received from the remote device (101) to the optimal secondary device (104) during the CMS session, wherein the media data packets are forwarded to the optimal secondary device (104) without transcoding any of the media data packets by the primary device (102).

[Claim 5] The primary device (102) as claimed in claim 1, facilitate media data transfer between the remote device and the optimal secondary device (104) comprises:
receive media data packets from the optimal secondary device (104) during the CMC session, wherein the media data packets are to be transmitted to the remote device (101); and
forward the media data packets received from the optimal secondary device (104) to the remote device (101) during the operator network session, wherein the media data packets are forwarded to the remote device (101) without transcoding any of the data packets by the primary device (102).

[Claim 6] The primary device (102) as claimed in claim 1, comprising:
detect a trigger event associated with the optimal secondary device (104);
transmit a communication-pull notification message to the optimal secondary device (104);
terminate the CMC session between the primary device (102) and the optimal secondary device (104);
renegotiate at least one optimal media parameter from the plurality of media parameters for the operator network session with the remote device (101) based on the capability information of the primary device (102); and

continue the media data transfer between the primary device (102) and the remote device (101) based on the at least one negotiated media parameter.

[Claim 7] The primary device (102) as claimed in claim 1, comprising:
detect a trigger event associated with the primary device (102);
establish the CMC session between the primary device (102) and the optimal secondary device (104);
renegotiate at least one optimal media parameter from the plurality of media parameters for the CMC session and the operator network session with the remote device (101) based on the capability information of at least one secondary device (104); and
continue the media data transfer between the remote device (101) and the secondary device (104) based on the at least one negotiated media parameter.

[Claim 8] The primary device (102) as claimed in claim 7, wherein the trigger event is at least one of a level of battery of the optimal secondary device (104) meets a battery threshold, detecting that capability of the primary device (102) is more
than capability of the optimal secondary device
(104), and a communication signal strength of the optimal secondary device (104) meets a signal strength threshold, personal preference or choice of user.

[Claim 9] The primary device (102) as claimed in claim 1, wherein the plurality of media parameters comprises codec resolution, frames per second, sampling rate, and content information.

[Claim 10] A method for managing Call and Message Continuity (CMC) session, comprising:
receiving, by a primary device (102), capability information of a plurality of secondary devices (104) from a CMC server (103);
receiving, by the primary device (102), a communication request message from a remote device (101) to establish the CMC session with the primary device (102), wherein the communication request message comprises a plurality of media parameters of the remote device (101);
determining, by the primary device (102), an optimal secondary device (104) from the plurality of secondary devices (104) based on the capability information of each of the secondary devices

(104) and the plurality of media parameters received from the remote device (101);

establishing, by the primary device (102), the CMC session with the optimal secondary device (104) by forwarding the communication request message comprising the plurality of media parameters to the CMC server (103);

receiving, by the primary device (102), a communication accept message from the CMC server (103), wherein the communication accept message comprises at least one negotiated media parameter from the plurality of media parameters by the optimal secondary device (104) for the CMC session;

forwarding, by the primary device (102), the communication accept message received from the CMC server (103) to the remote device (101); and

facilitating, by the primary device (102), media data transfer between the remote device (101) and the optimal secondary device (104).

[Claim 11] The method as claimed in claim 10, wherein the communication request message is received from the remote device (101) to establish an operator network session with the primary device (102).

[Claim 12] The method as claimed in claim 10, wherein the communication request message comprising the plurality of media parameters is forwarded to the optimal secondary device (104) without stripping any of the media parameters received in the communication request message.

[Claim 13] The method as claimed in claim 10, wherein the communication accept message comprising the at least one negotiated media parameter is forwarded to the remote device (101) without stripping any of the at least one negotiated media parameter received in the communication accept message.

[Claim 14] The method as claimed in claim 10, facilitating, by the primary device (102), the media data transfer between the remote device and the optimal secondary device (104) comprises:

receiving, by the primary device (102), media data packets from the remote device (101) during an operator network session, wherein the media data packets are to be transmitted to the optimal secondary device (104); and

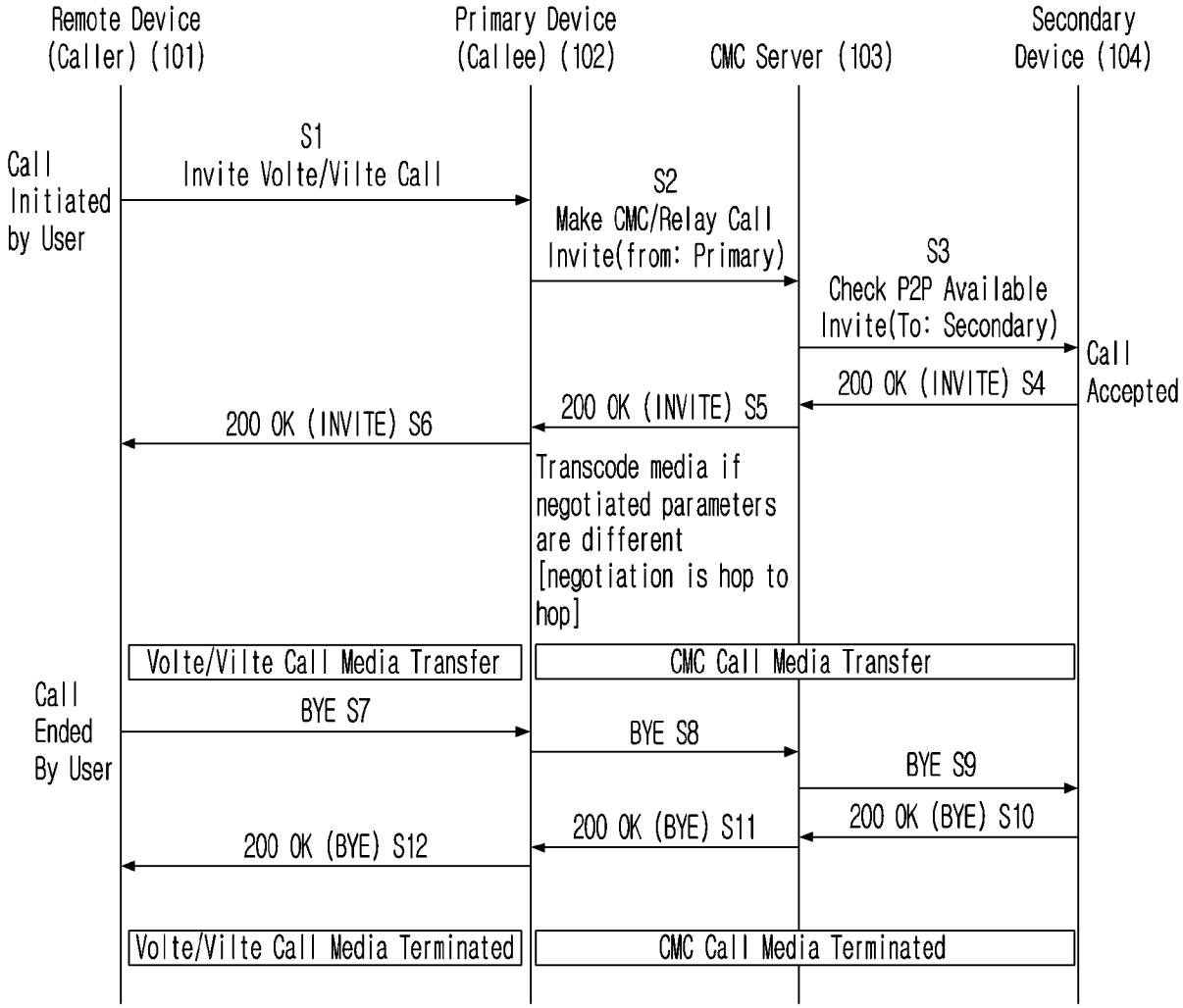
forwarding, by the primary device (102), the media data packets received from the remote device to the optimal secondary device (104) during the CMS session, wherein the media data packets are forwarded to the optimal secondary device (104) without transcoding any of the media data packets by the primary device (102).

[Claim 15] The method as claimed in claim 10, facilitating, by the primary device (102), media data transfer between the remote device (101) and the optimal secondary device (104) comprises:

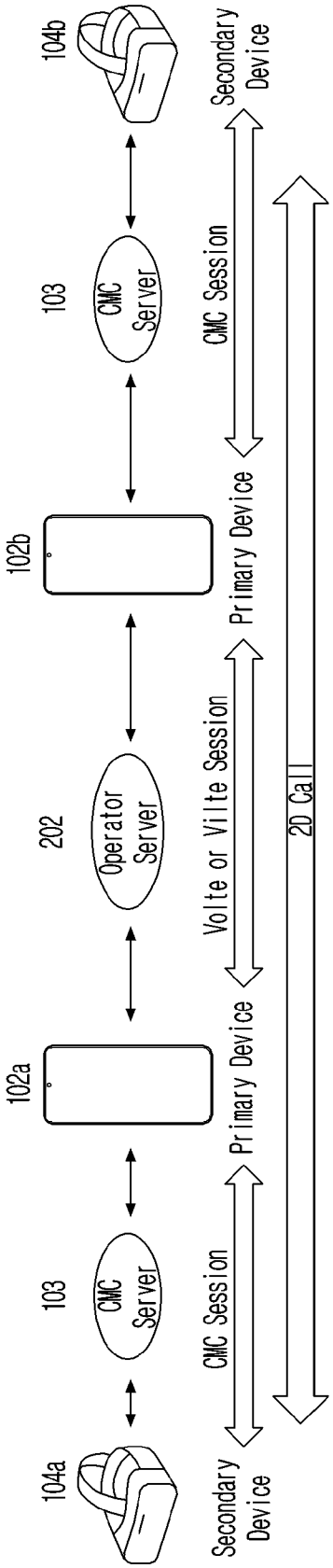
receiving, by the primary device (102), media data packets from the optimal secondary device (104) during the CMC session, wherein the media data packets are to be transmitted to the remote device (101); and

forwarding, by the primary device (102), the media data packets received from the optimal secondary device (104) to the remote device (101) during an operator network session, wherein the media data packets are forwarded to the remote device (101) without transcoding any of the data packets by the primary device (102).

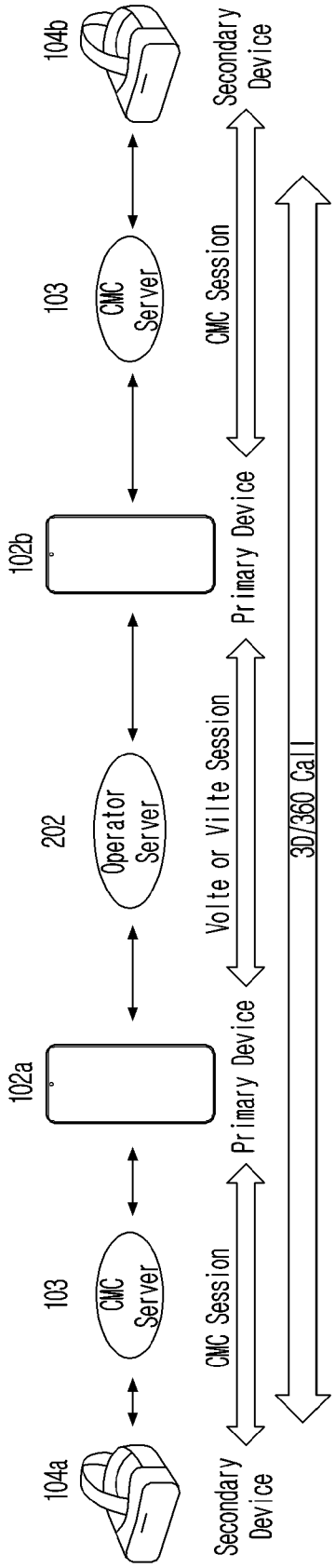
[Fig. 1]


Remote Device (Caller) (101)
Primary Device (Callee) (102)
CMC Server (103)
Secondary Device (104)
Call Initiated by User
S1
Invite Volte/Vilte Call
S2
Make CMC/Relay Call
Invite(from: Primary)
S3
Check P2P Available
Invite(To: Secondary)
Call Accepted
200 OK (INVITE) S4
200 OK (INVITE) S5
200 OK (INVITE) S6
Transcode media if negotiated parameters are different [negotiation is hop to hop]
Volte/Vilte Call Media Transfer
CMC Call Media Transfer
Call Ended By User
BYE S7
BYE S8
BYE S9
200 OK (BYE) S10
200 OK (BYE) S11
200 OK (BYE) S12
Volte/Vilte Call Media Terminated
CMC Call Media Terminated

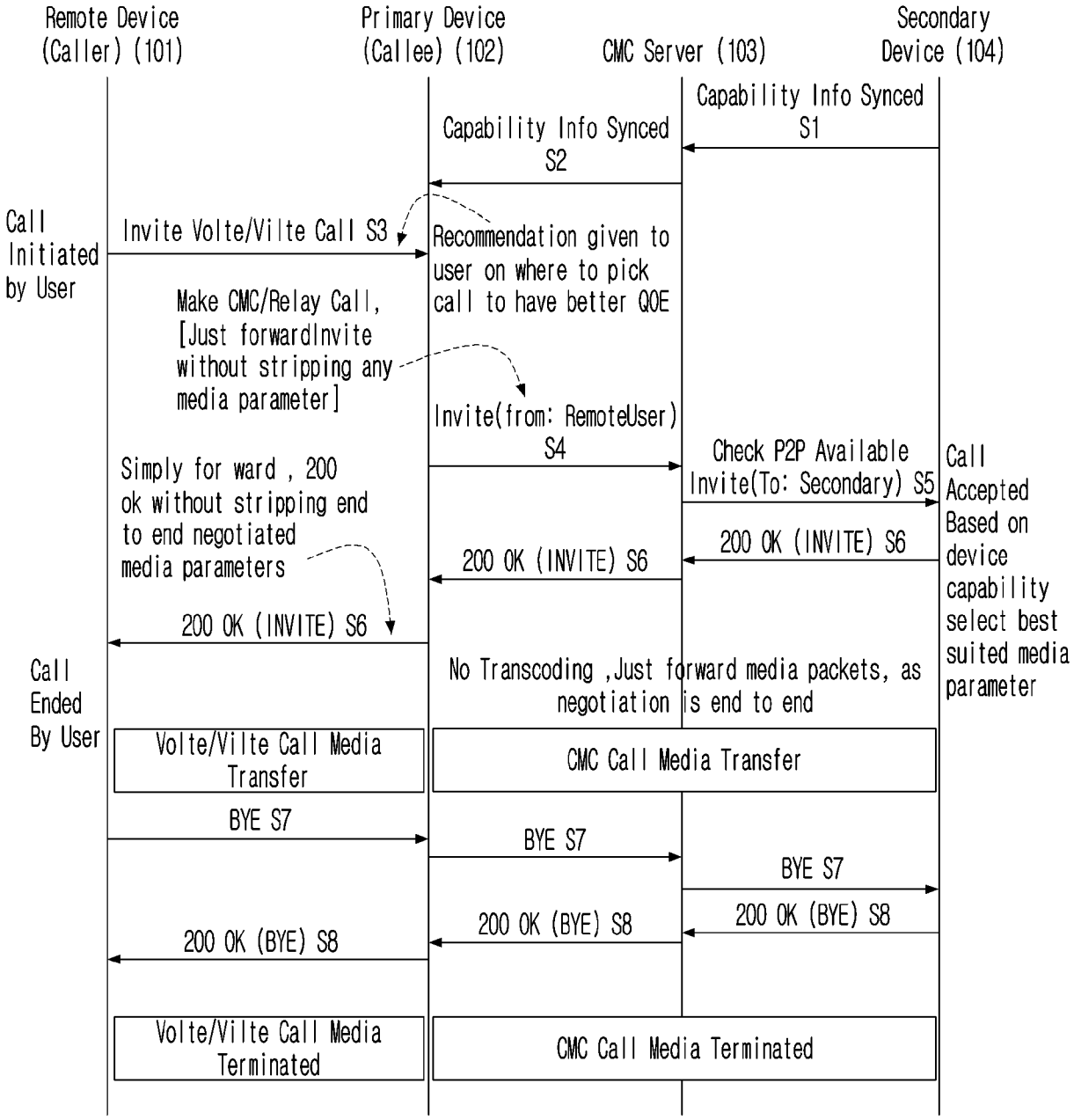
[Fig. 2]


104b
Secondary Device
103
CMC Server
CMC Session
102b
Primary Device
202
Operator Server
Volte or Vilte Session
2D Call
102a
Primary Device
103
CMC Server
CMC Session
104a
Secondary Device

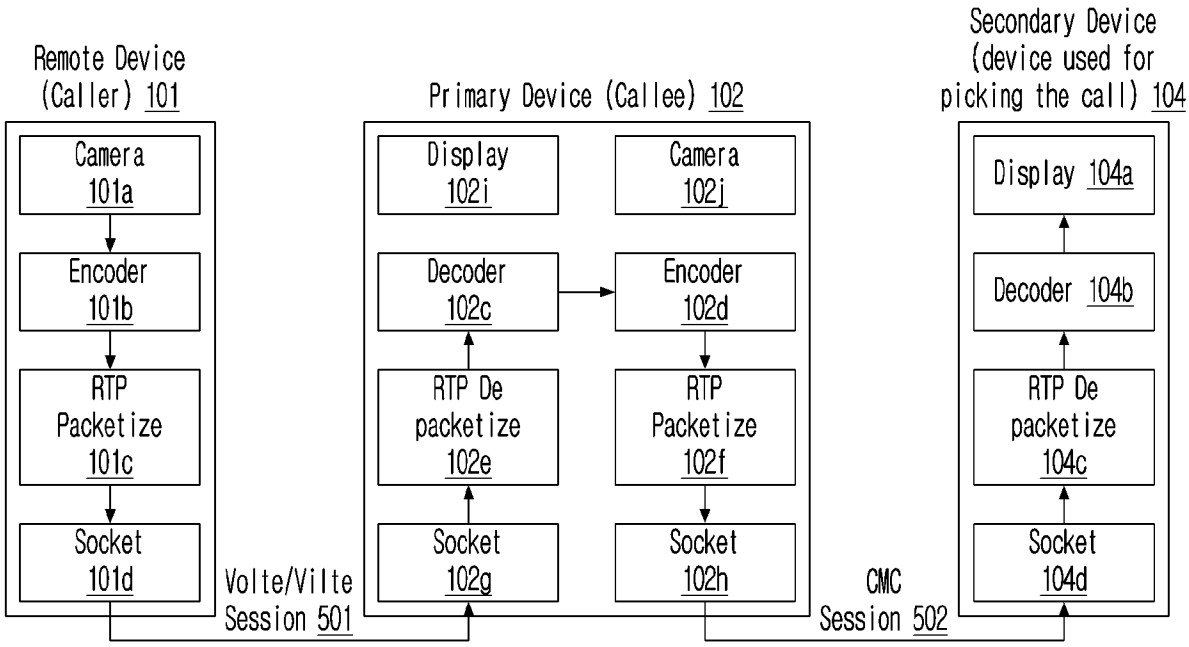
[Fig. 3]


104b
Secondary Device
103
CMC Server
CMC Session
102b
Primary Device
202
Operator Server
Volte or Vilte Session
102a
Primary Device
103
CMC Server
CMC Session
104a
Secondary Device
3D/360 Call

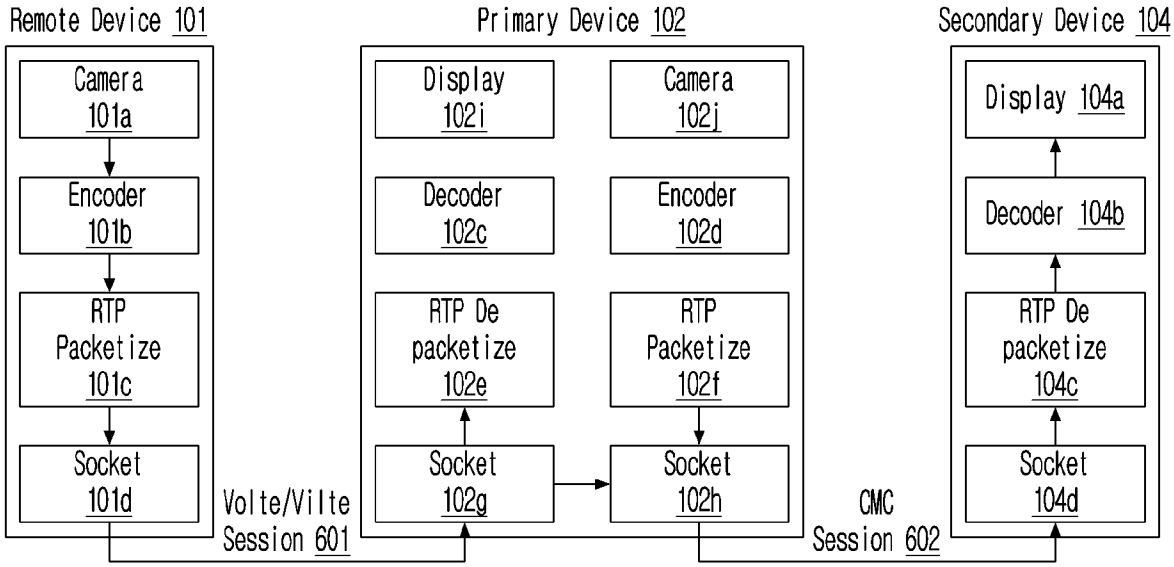
[Fig. 4]


Remote Device (Caller) (101)
Primary Device (Callee) (102)
CMC Server (103)
Secondary Device (104)
Capability Info Synced S1
Capability Info Synced S2
Call Initiated by User
Invite Volte/Vilte Call S3
Recommendation given to user on where to pick call to have better QOE
Make CMC/Relay Call, [Just forwardInvite without stripping any media parameter]
Invite(from: RemoteUser) S4
Check P2P Available Invite(To: Secondary) S5
Call Accepted Based on device capability select best suited media parameter
200 OK (INVITE) S6
200 OK (INVITE) S6
Simply for ward , 200 ok without stripping end to end negotiated media parameters
200 OK (INVITE) S6
Call Ended By User
No Transcoding ,Just forward media packets, as negotiation is end to end
Volte/Vilte Call Media Transfer
CMC Call Media Transfer
BYE S7
BYE S7
BYE S7
200 OK (BYE) S8
200 OK (BYE) S8
200 OK (BYE) S8
Volte/Vilte Call Media Terminated
CMC Call Media Terminated

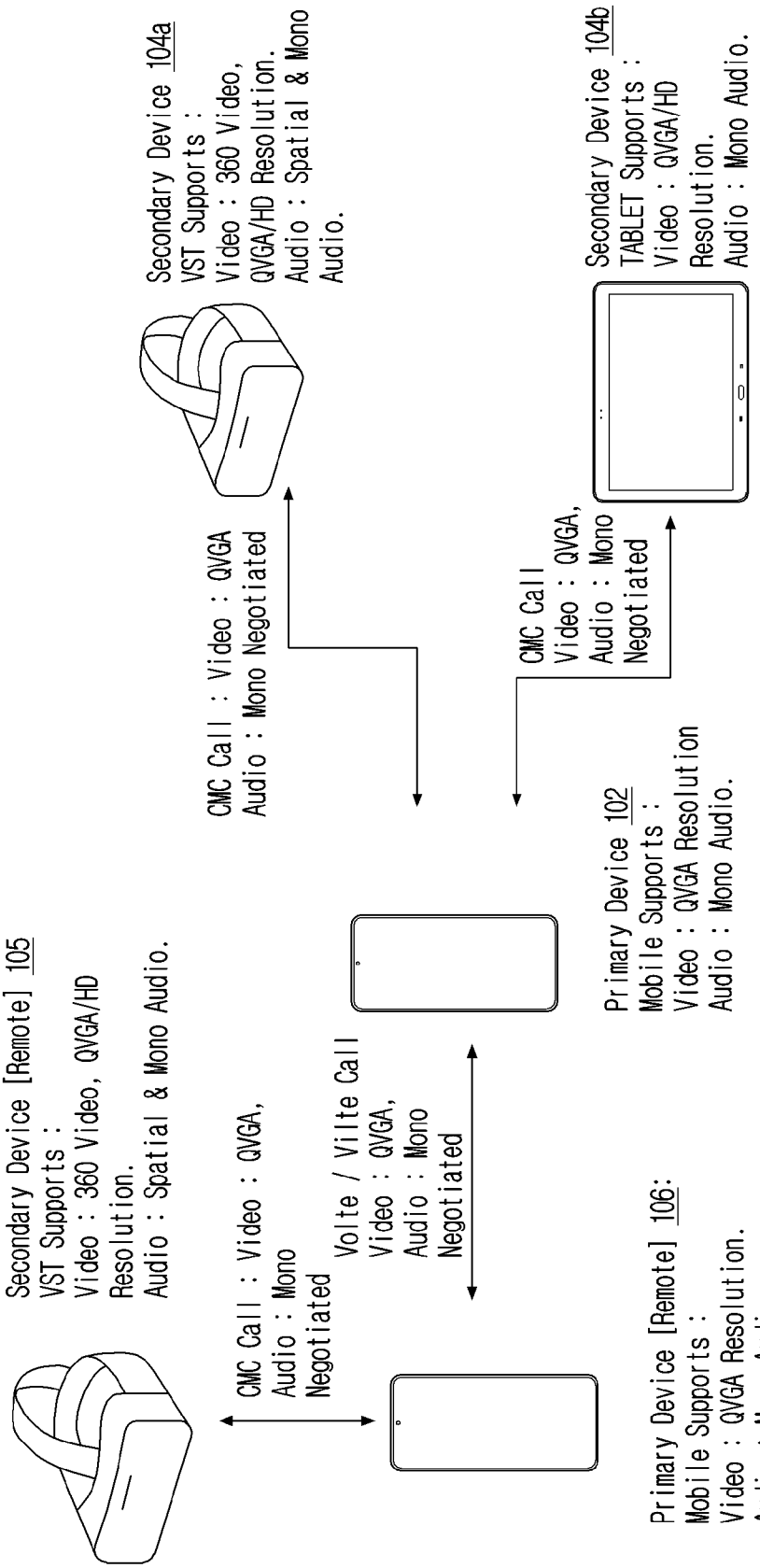
[Fig. 5]


Remote Device (Caller) 101
Primary Device (Callee) 102
Secondary Device (device used for picking the call) 104
Camera 101a
Encoder 101b
RTP Packetize 101c
Socket 101d
Display 102i
Camera 102j
Decoder 102c
Encoder 102d
RTP De packetize 102e
RTP Packetize 102f
Socket 102g
Socket 102h
Display 104a
Decoder 104b
RTP De packetize 104c
Socket 104d
Volte/Vilte Session 501
CMC Session 502

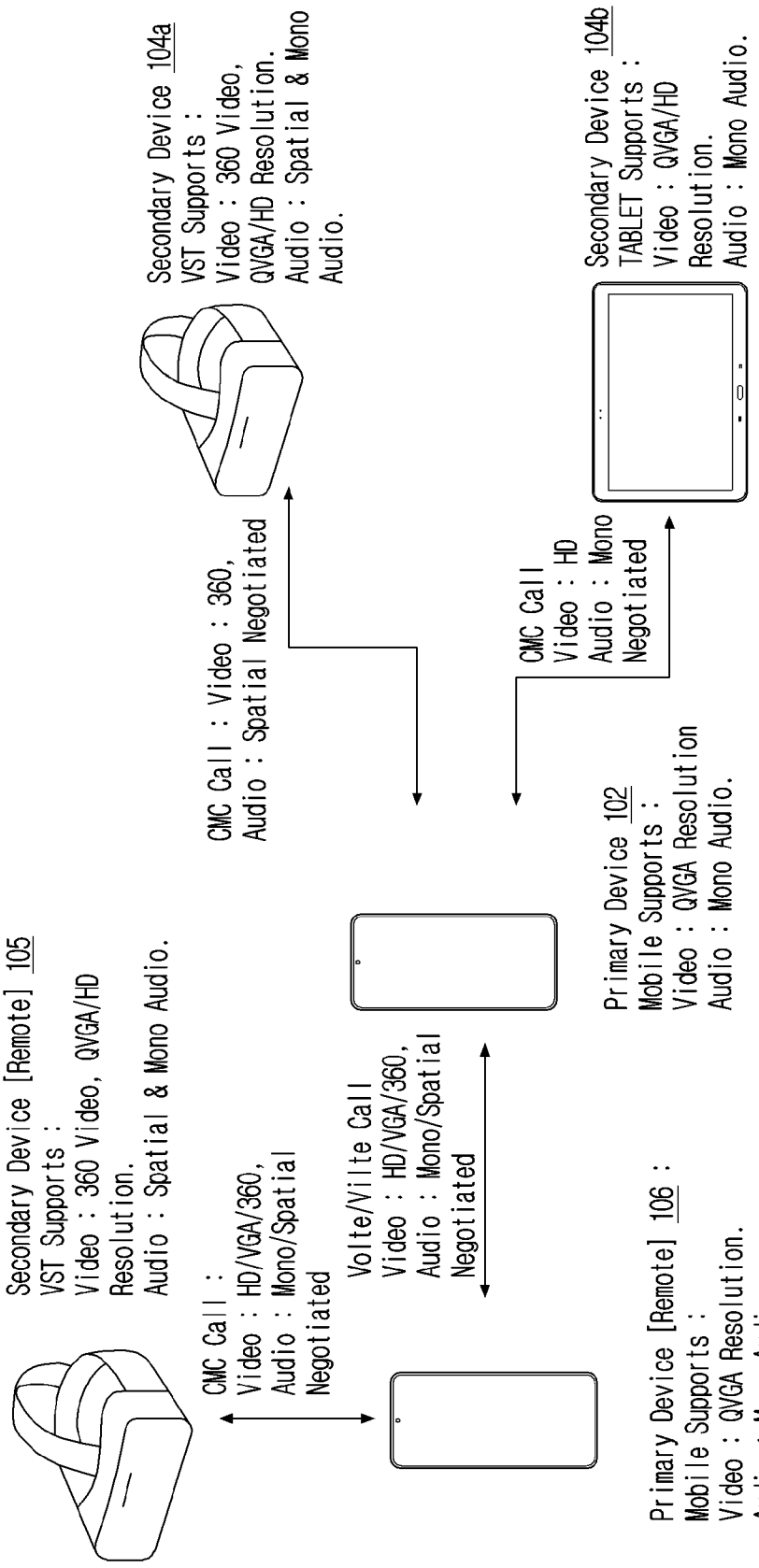
[Fig. 6]


Remote Device 101
Primary Device 102
Secondary Device 104
Camera 101a
Encoder 101b
RTP Packetize 101c
Socket 101d
Display 102i
Camera 102j
Decoder 102c
Encoder 102d
RTP De packetize 102e
RTP Packetize 102f
Socket 102g
Socket 102h
Display 104a
Decoder 104b
RTP De packetize 104c
Socket 104d
Volte/Vilte Session 601
CMC Session 602

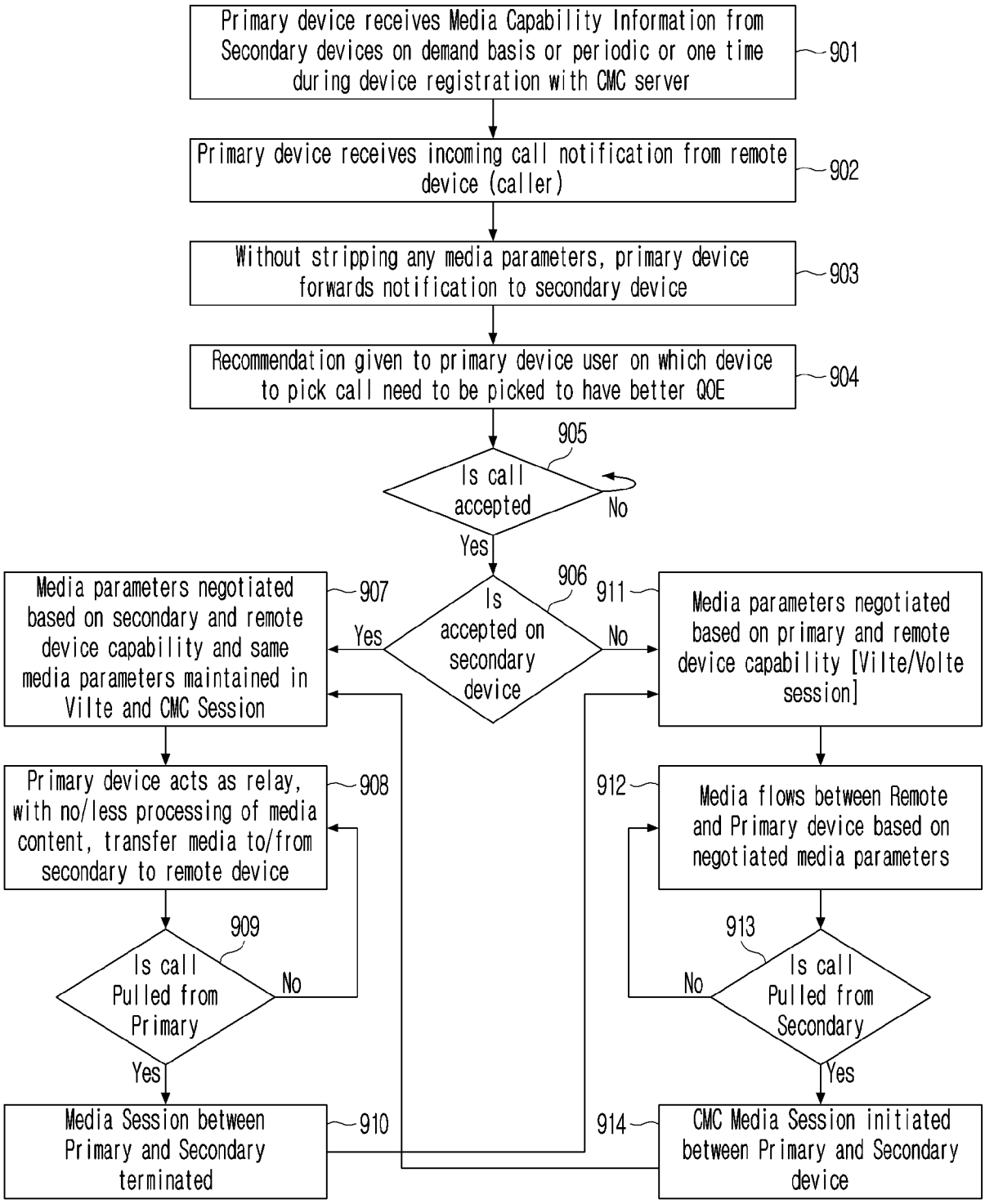
[Fig. 7]


Secondary Device [Remote] 105
VST Supports :
Video : 360 Video, QVGA/HD
Resolution.
Audio : Spatial & Mono Audio.
CMC Call : Video : QVGA,
Audio : Mono
Negotiated
Volte / Vilte Call
Video : QVGA,
Audio : Mono
Negotiated
Primary Device [Remote] 106:
Mobile Supports :
Video : QVGA Resolution.
Audio : Mono Audio.
Secondary Device 104a
VST Supports :
Video : 360 Video,
QVGA/HD Resolution.
Audio : Spatial & Mono
Audio.
CMC Call : Video : QVGA
Audio : Mono Negotiated
CMC Call
Video : QVGA,
Audio : Mono
Negotiated
Primary Device 102
Mobile Supports :
Video : QVGA Resolution
Audio : Mono Audio.
Secondary Device 104b
TABLET Supports :
Video : QVGA/HD
Resolution.
Audio : Mono Audio.

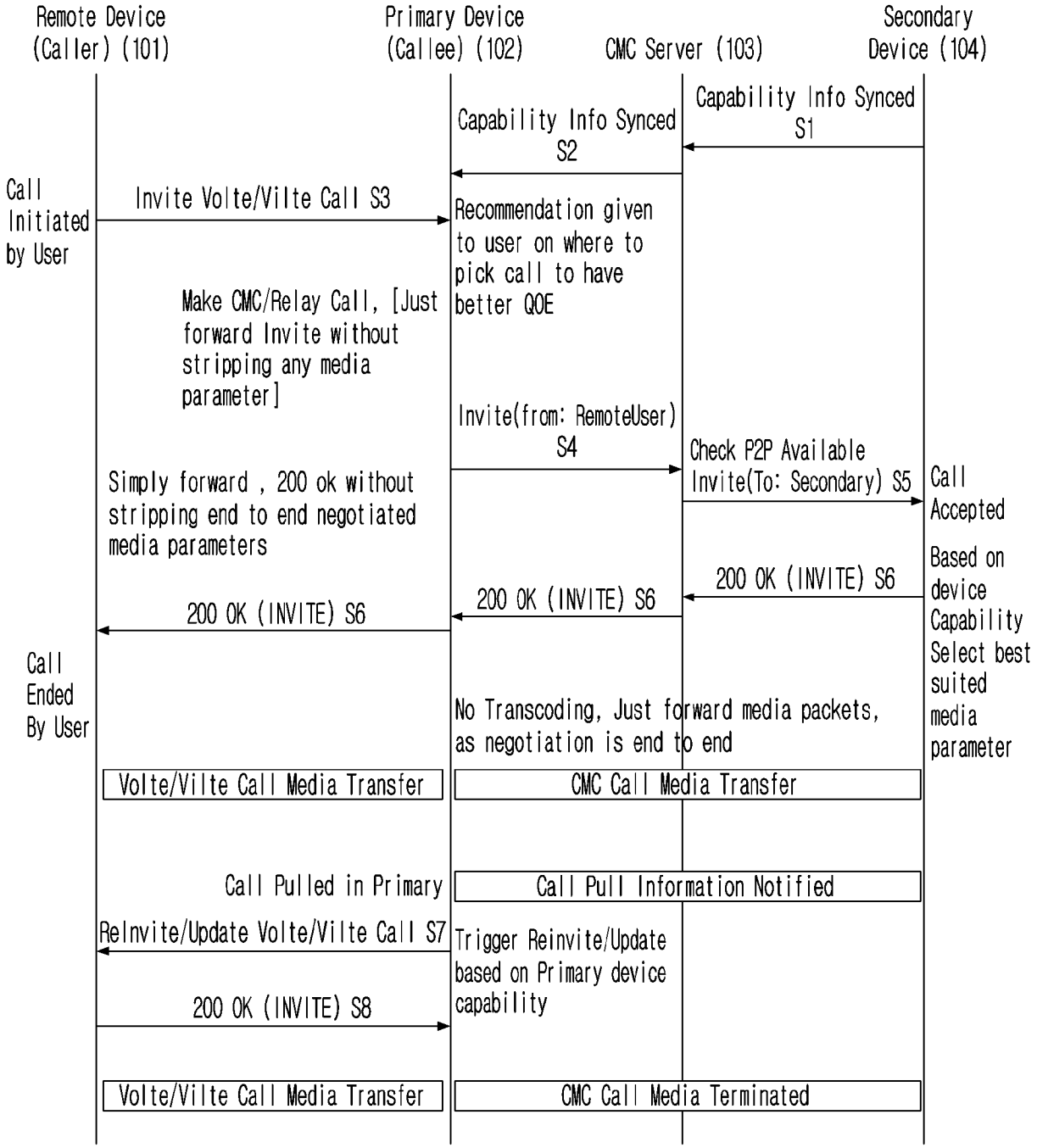
[Fig. 8]


Secondary Device [Remote] 105
VST Supports :
Video : 360 Video, QVGA/HD
Resolution.
Audio : Spatial & Mono Audio.
CMC Call :
Video : HD/VGA/360,
Audio : Mono/Spatial
Negotiated
Volte/Vilte Call
Video : HD/VGA/360,
Audio : Mono/Spatial
Negotiated
Primary Device [Remote] 106 :
Mobile Supports :
Video : QVGA Resolution.
Audio : Mono Audio.
CMC Call : Video : 360,
Audio : Spatial Negotiated
Secondary Device 104a
VST Supports :
Video : 360 Video,
QVGA/HD Resolution.
Audio : Spatial & Mono
Audio.
CMC Call
Video : HD
Audio : Mono
Negotiated
Primary Device 102
Mobile Supports :
Video : QVGA Resolution
Audio : Mono Audio.
Secondary Device 104b
TABLET Supports :
Video : QVGA/HD
Resolution.
Audio : Mono Audio.

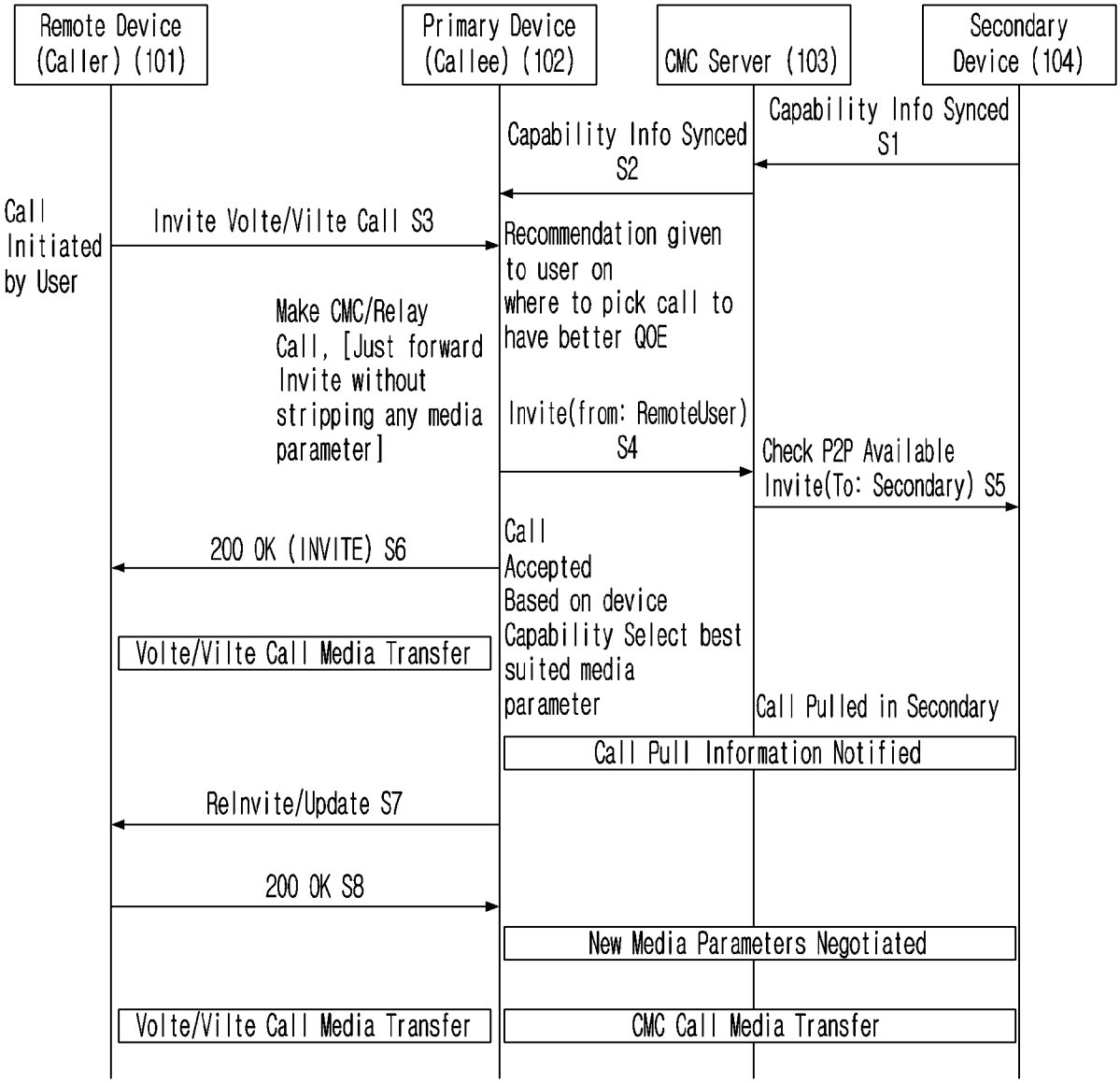
[Fig. 9]


Primary device receives Media Capability Information from Secondary devices on demand basis or periodic or one time during device registration with CMC server
901
Primary device receives incoming call notification from remote device (caller)
902
Without stripping any media parameters, primary device forwards notification to secondary device
903
Recommendation given to primary device user on which device to pick call need to be picked to have better QOE
904
905
Is call accepted
No
Yes
906
Is accepted on secondary device
Yes
No
907
Media parameters negotiated based on secondary and remote device capability and same media parameters maintained in Vilte and CMC Session
911
Media parameters negotiated based on primary and remote device capability [Vilte/Volte session]
908
Primary device acts as relay, with no/less processing of media content, transfer media to/from secondary to remote device
912
Media flows between Remote and Primary device based on negotiated media parameters
909
Is call Pulled from Primary
No
Yes
913
Is call Pulled from Secondary
No
Yes
910
Media Session between Primary and Secondary terminated
914
CMC Media Session initiated between Primary and Secondary device

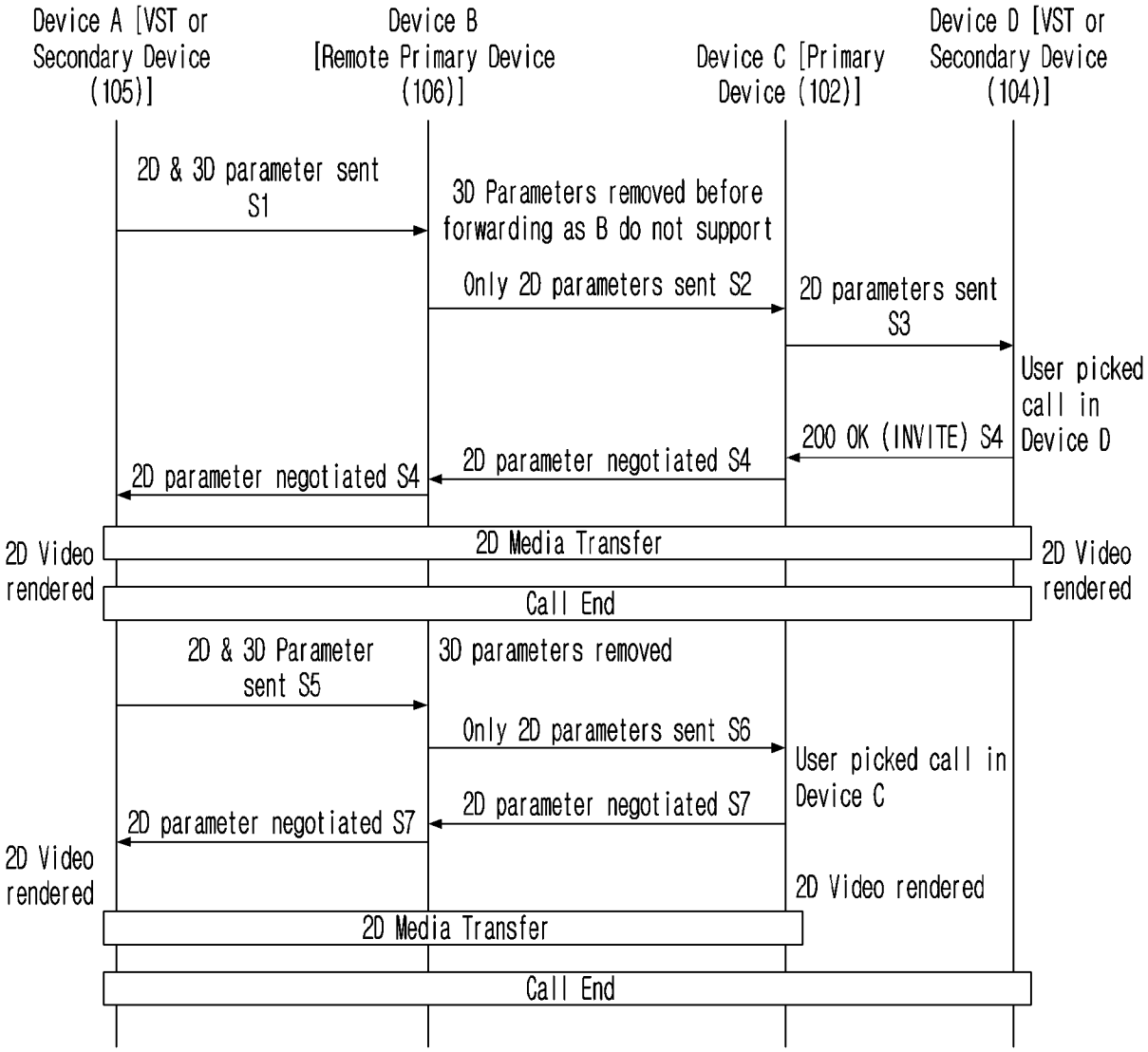
[Fig. 10]


Remote Device (Caller) (101)
Primary Device (Callee) (102)
CMC Server (103)
Secondary Device (104)
Capability Info Synced S1
Capability Info Synced S2
Call Initiated by User
Invite Volte/Vilte Call S3
Recommendation given to user on where to pick call to have better QOE
Make CMC/Relay Call, [Just forward Invite without stripping any media parameter]
Invite(from: RemoteUser) S4
Check P2P Available
Invite(To: Secondary) S5
Call Accepted
Simply forward , 200 ok without stripping end to end negotiated media parameters
200 OK (INVITE) S6
200 OK (INVITE) S6
Based on device Capability Select best suited media parameter
200 OK (INVITE) S6
Call Ended By User
No Transcoding, Just forward media packets, as negotiation is end to end
Volte/Vilte Call Media Transfer
CMC Call Media Transfer
Call Pulled in Primary
Call Pull Information Notified
ReInvite/Update Volte/Vilte Call S7
Trigger Reinvite/Update based on Primary device capability
200 OK (INVITE) S8
Volte/Vilte Call Media Transfer
CMC Call Media Terminated

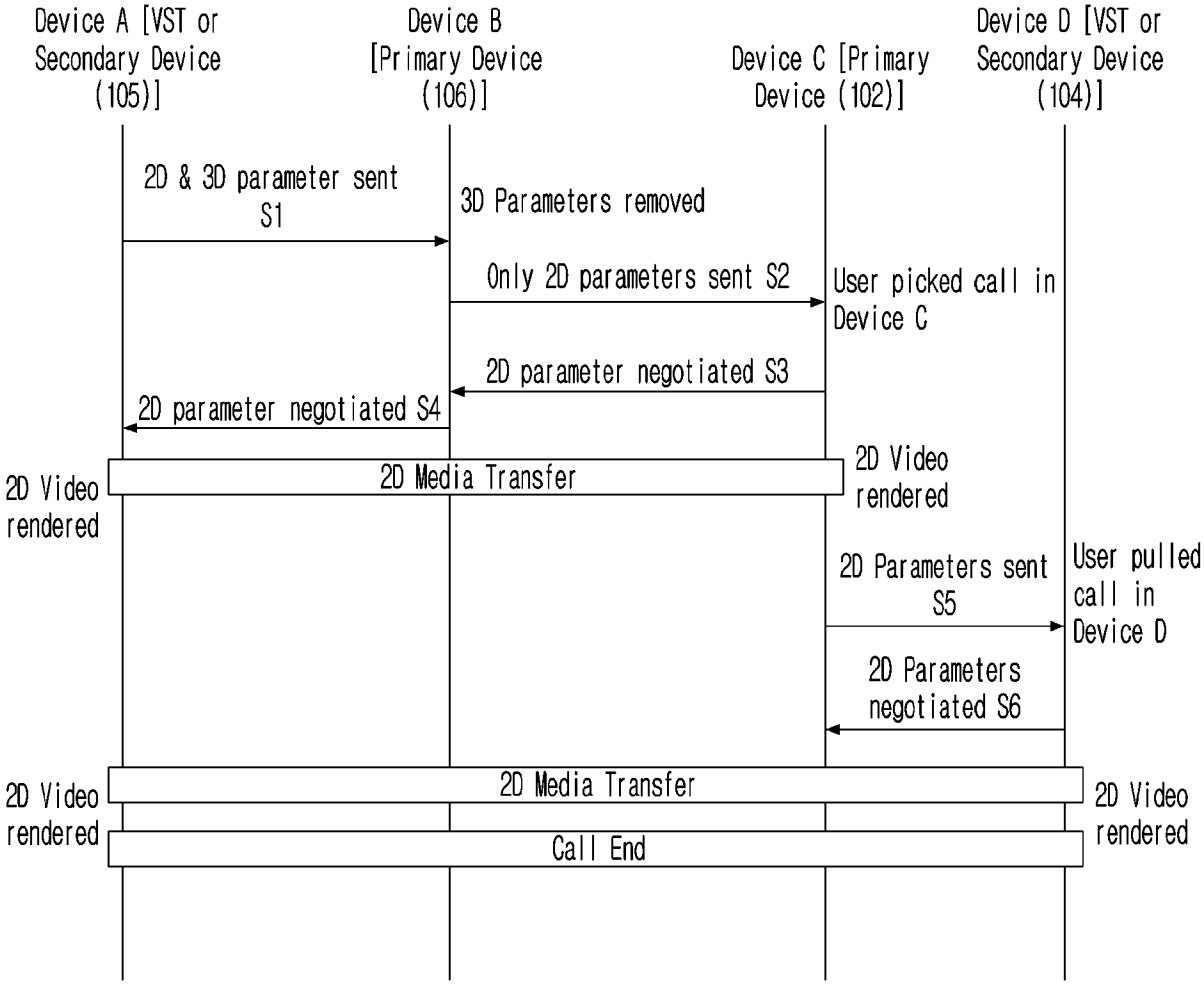
[Fig. 11]


Remote Device (Caller) (101)
Primary Device (Callee) (102)
CMC Server (103)
Secondary Device (104)
Capability Info Synced S1
Capability Info Synced S2
Call Initiated by User
Invite Volte/Vilte Call S3
Recommendation given to user on where to pick call to have better QOE
Make CMC/Relay Call, [Just forward Invite without stripping any media parameter]
Invite(from: RemoteUser) S4
Check P2P Available
Invite(To: Secondary) S5
200 OK (INVITE) S6
Call Accepted Based on device Capability Select best suited media parameter
Volte/Vilte Call Media Transfer
Call Pulled in Secondary
Call Pull Information Notified
ReInvite/Update S7
200 OK S8
New Media Parameters Negotiated
Volte/Vilte Call Media Transfer
CMC Call Media Transfer

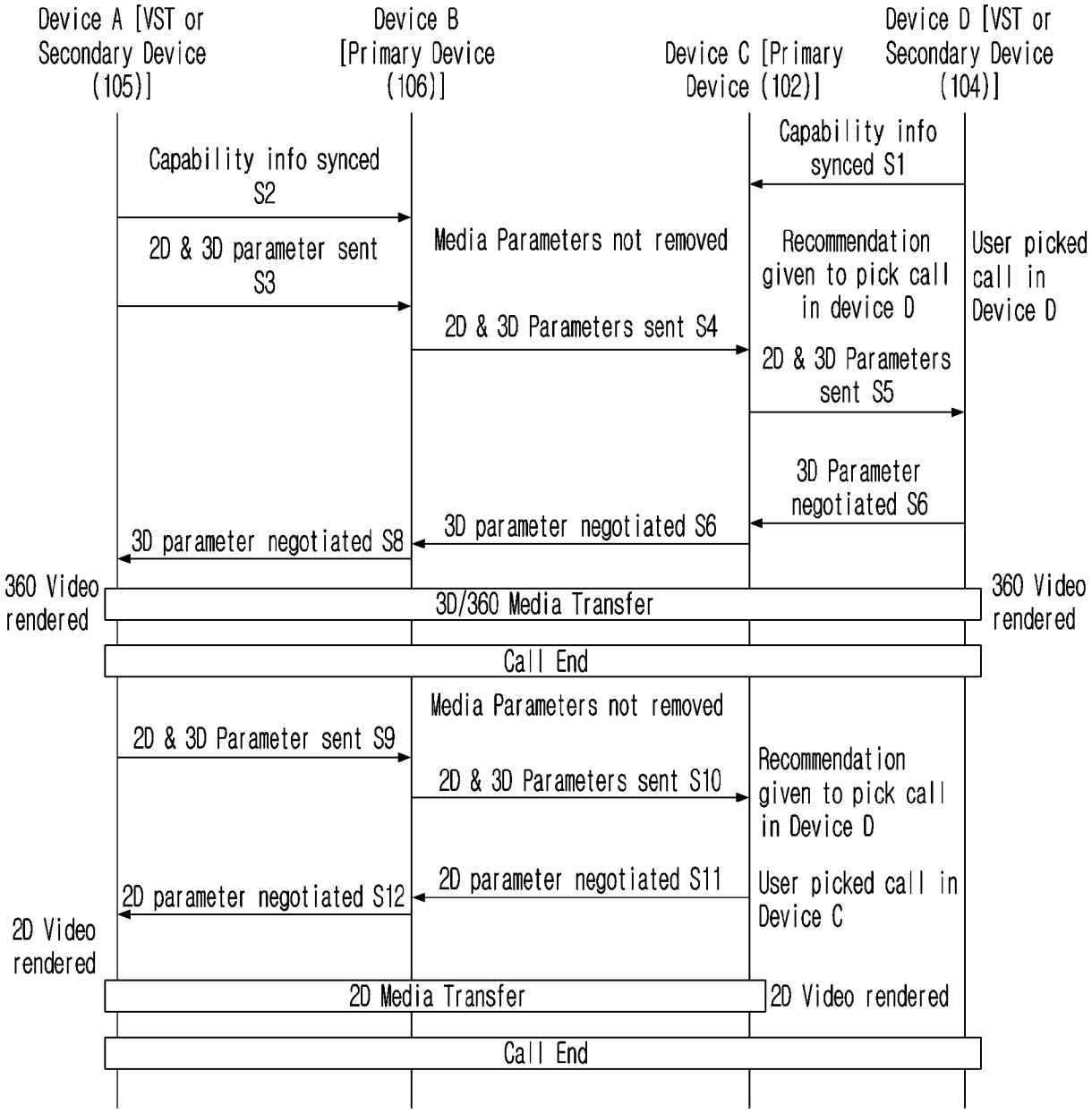
[Fig. 12]


Device A [VST or Secondary Device (105)]
Device B [Remote Primary Device (106)]
Device C [Primary Device (102)]
Device D [VST or Secondary Device (104)]
2D & 3D parameter sent S1
3D Parameters removed before forwarding as B do not support
Only 2D parameters sent S2
2D parameters sent S3
User picked call in Device D
200 OK (INVITE) S4
2D parameter negotiated S4
2D parameter negotiated S4
2D Media Transfer
2D Video rendered
2D Video rendered
Call End
2D & 3D Parameter sent S5
3D parameters removed
Only 2D parameters sent S6
User picked call in Device C
2D parameter negotiated S7
2D parameter negotiated S7
2D Video rendered
2D Video rendered
2D Media Transfer
Call End

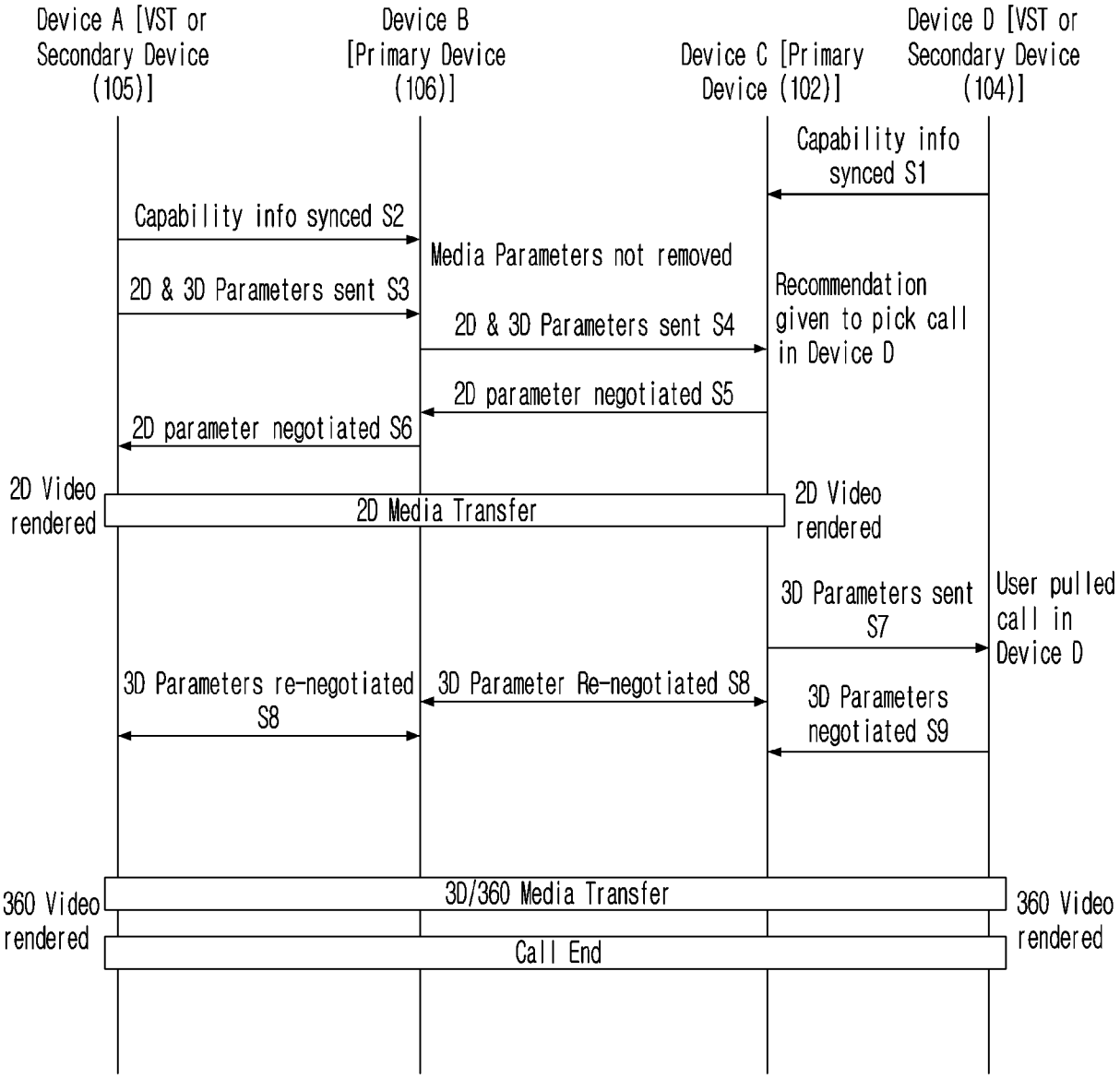
[Fig. 13]


Device A [VST or Secondary Device (105)]
Device B [Primary Device (106)]
Device C [Primary Device (102)]
Device D [VST or Secondary Device (104)]
2D & 3D parameter sent S1
3D Parameters removed
Only 2D parameters sent S2
User picked call in Device C
2D parameter negotiated S3
2D parameter negotiated S4
2D Media Transfer
2D Video rendered
2D Video rendered
2D Parameters sent S5
User pulled call in Device D
2D Parameters negotiated S6
2D Media Transfer
2D Video rendered
2D Video rendered
Call End

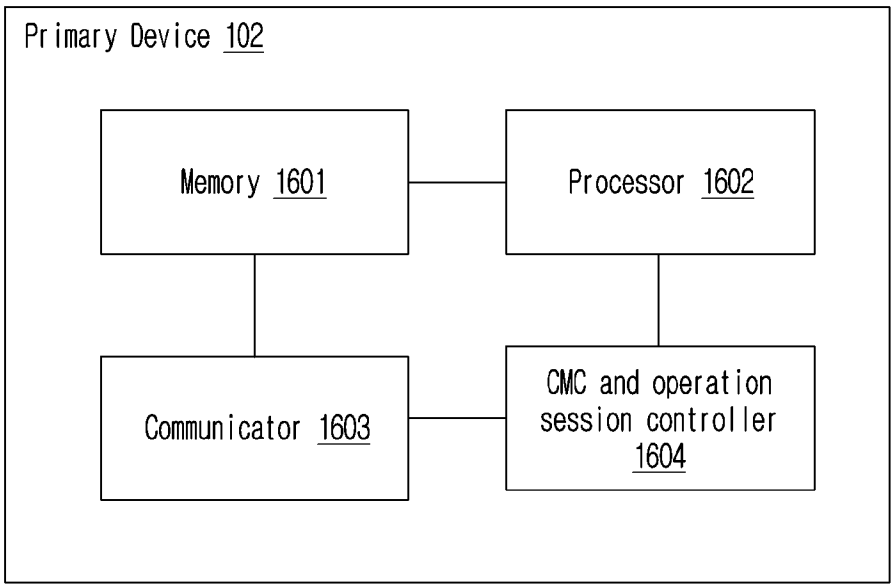
[Fig. 14]


Device A [VST or Secondary Device (105)]
Device B [Primary Device (106)]
Device C [Primary Device (102)]
Device D [VST or Secondary Device (104)]
Capability info synced S1
Capability info synced S2
2D & 3D parameter sent S3
Media Parameters not removed
Recommendation given to pick call in device D
User picked call in Device D
2D & 3D Parameters sent S4
2D & 3D Parameters sent S5
3D Parameter negotiated S6
3D parameter negotiated S8
3D parameter negotiated S6
360 Video rendered
3D/360 Media Transfer
360 Video rendered
Call End
Media Parameters not removed
2D & 3D Parameter sent S9
2D & 3D Parameters sent S10
Recommendation given to pick call in Device D
2D parameter negotiated S12
2D parameter negotiated S11
User picked call in Device C
2D Video rendered
2D Media Transfer
2D Video rendered
Call End

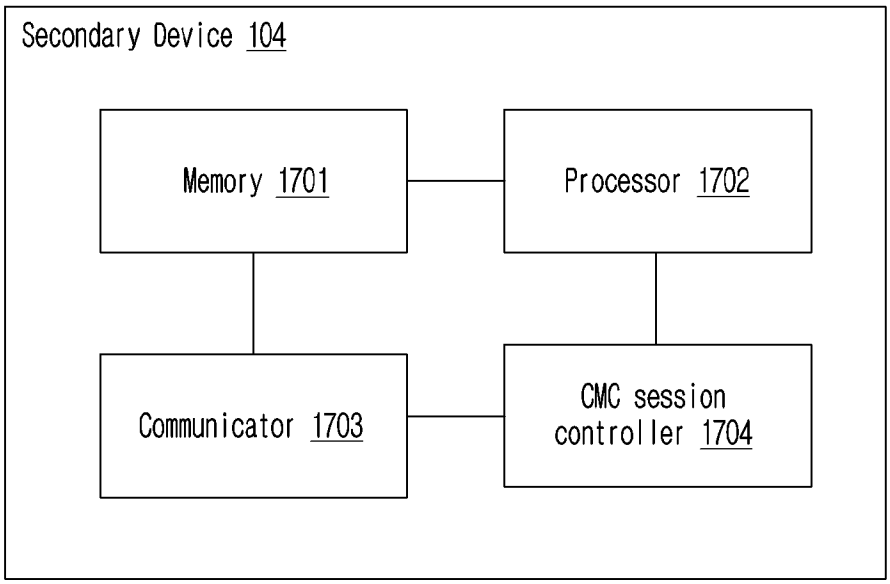
[Fig. 15]


Device A [VST or Secondary Device (105)]
Device B [Primary Device (106)]
Device C [Primary Device (102)]
Device D [VST or Secondary Device (104)]
Capability info synced S1
Capability info synced S2
Media Parameters not removed
2D & 3D Parameters sent S3
Recommendation given to pick call in Device D
2D & 3D Parameters sent S4
2D parameter negotiated S5
2D parameter negotiated S6
2D Video rendered
2D Media Transfer
2D Video rendered
3D Parameters sent S7
User pulled call in Device D
3D Parameters re-negotiated S8
3D Parameter Re-negotiated S8
3D Parameters negotiated S9
3D/360 Media Transfer
360 Video rendered
360 Video rendered
Call End

[Fig. 16]


Primary Device 102
Memory 1601
Processor 1602
Communicator 1603
CMC and operation session controller 1604

[Fig. 17]


Secondary Device 104
Memory 1701
Processor 1702
Communicator 1703
CMC session controller 1704

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2024/007810

A. CLASSIFICATION OF SUBJECT MATTER

H04L 65/1094(2022.01)i; **H04L 65/1069**(2022.01)i; **H04L 65/1046**(2022.01)i

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)

H04L 65/1094(2022.01); G06F 15/16(2006.01); G06F 15/173(2006.01); H04L 29/06(2006.01); H04M 3/42(2006.01); H04W 4/16(2009.01); H04W 4/80(2018.01); H04W 8/02(2009.01)

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

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: CMC(Call and Message Continuity), capability, call request, register, media parameter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 2022-186562 A1 (SAMSUNG ELECTRONICS CO., LTD.) 09 September 2022 (2022-09-09) paragraphs [0050]-[0055], [0076]-[0098], [0116], [0163]; claim 1; and figure 3	1-15
Y	US 2009-0052651 A1 (AKINORI IWAKAWA et al.) 26 February 2009 (2009-02-26) paragraphs [0029]-[0032]; and claim 7	1-15
A	US 2018-0159906 A1 (ZTE CORPORATION) 07 June 2018 (2018-06-07) claims 1-7, 10-15, 17, 20-25	1-15
A	US 9485146 B1 (AMAZON TECHNOLOGIES, INC.) 01 November 2016 (2016-11-01) claims 1-20	1-15
A	US 2013-0275615 A1 (OZGUR OYMAN) 17 October 2013 (2013-10-17) paragraphs [0023]-[0094]; and claims 1-17	1-15

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
13 September 2024	**13 September 2024**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office **189 Cheongsa-ro, Seo-gu, Daejeon** **35208, Republic of Korea**	**YANG, Jeong Rok**
Facsimile No. **+82-42-481-8578**	Telephone No. **+82-42-481-5709**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2024/007810

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