[0001] # SESSION INITIATION PROTOCOL (SIP) BASED USER INITIATED HANDOFF

[0002] ## FIELD OF INVENTION

[0003] The present invention relates to performing a handoff between two devices which employ different technologies and which are connected to an internet protocol (IP) network by way of two different systems. More particularly, the present invention is related to a method and apparatus for performing a handoff employing SIP protocol conducted during real time sessions between such different devices, and either such different networks or a common network.

[0004] ## BACKGROUND

[0005] Session initiation protocol (SIP) protocol is employed to initiate and to modify a multimedia session over the internet protocol (IP) network. For example, SIP is used in one of a universal mobile telecommunications system (UMTS) network to establish a multimedia session between two users wherein at least one of the users operates on the UMTS system. However, SIP protocol has not heretofore been utilized as a mechanism to perform handoff between different devices operating in different systems.

[0006] ## SUMMARY

[0007] The present invention is characterized by method and apparatus for providing a unique solution to the handoff problem including negotiation of new media codecs (coders/decoders) for utilization in cases where the two devices involved in the handoff are incompatible. Although mobile IP (MIP) is presently utilized to perform handoff procedures, this technique lacks a trigger mechanism to initiate handoff between two different devices which communicate with two different networks or one common network. In addition, MIP does not address the issue of compatibilities between media types, codecs and supported bit rate.

[0008] BRIEF DESCRIPTION OF THE FIGURES

[0009] The present invention will be understood from a consideration of the accompanying figures wherein like elements are designated by like numerals and, wherein:

[0010] Figure 1 is a simplified schematic diagram of a network architecture incorporating two incompatible devices and two different systems communicating with said devices.

[0011] Figure 2 is a flow diagram showing the manner in which a handoff from a wireless local area network (WLAN) network user to a UMTS network user is triggered from the WLAN network;

[0012] Figure 3 is a flow diagram showing the manner in which a handoff from a WLAN network user to a UMTS network user is triggered from a UMTS network.

[0013] Figure 4 is a flow diagram similar to that of Figure 2 wherein the handoff is made from the UMTS user to the WLAN network user and is triggered from the WLAN network.

[0014] Figure 5 is a flow diagram similar to that shown in Figure 3 wherein the handoff is made from a WLAN network user to a UMTS network user and is triggered from the UMTS network.

[0015] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Making reference to the network architecture 10 of Figure 1 there is shown therein two different wireless devices 12 and 32, device 12 being a personal computer (PC) having a WLAN card 13 enabling the device 12 to establish a wireless communication with a WLAN access point /access router (AP/AR) 14. PC 12 may be a desktop or laptop and is fitted with a WLAN card 13 and is able to establish a wireless communication with WLAN 14, through a suitable interface (not shown for purposes of simplicity). PC 12 is coupled to the AAA unit 16 through WLAN 14 to establish access, authorization and accounting (AAA) at 16 and is coupled through internet protocol (IP) network 18 and router

20 to a service server 22 in order to communicate with a called subscriber or other source (not shown) in the network, for example.

[0017] User equipment (UE) 32, which may be a wireless cell phone, PDA wireless device or other like device having similar capabilities, is adapted for wireless communication with a third generation partnership project (3 GPP) system 23. UE 32 communicates with the system 23 which receives a wireless message from UE 32 over antenna 30 that couples the communication to a general packet radio service (GPRS) support node (GSN) 28. The message is also conveyed from GSN 28 to a home subscriber server (HSS) 26 and an AAA 24 (similar to AAA 16) for access, authentication and accounting. The home subscriber server (HSS) 26 performs a number of database functions such as the home location register (HLR) function, which provides routing information for mobile terminated calls and short message service and maintains user subscription information which is distributed to the relevant visitor location register (VLR), not shown for purposes of simplicity, or is distributed to the serving GPRS support node (SGSN). The AAA 24 securely determines the identity and privileges of the UE and tracks the UE's activities.

[0018] A description will now be provided for performing a handoff using SIP when a user wishes to handoff an existing multimedia session between two different types of networks. The two different networks of the example to follow are a WLAN network 14 and a 3GPP UMTS network 23. The handoff will be described as from a PC, such as the PC 13 shown in Fig. 1 and equipped with a WLAN card 13, to a user equipment (UE) 32 which may be a cell phone or the like which optionally may also be equipped with image reception and display capability, to accommodate a multimedia session in accordance with the 3GPP standards.

[0019] Making reference to Fig. 2, in which a handoff is triggered by the WLAN network 14, it is assumed that there is a real time session between PC 12 and a called party which is represented in Figure 1 as a real time session in which PC 12 /WLAN card 13 communicates with WLAN network 14 shown at S1, WLAN network 14 communicating with IP network 18, shown at S2, the IP

network 18, in turn providing the two-way communication between the PC12 and service server 12, shown at S3. At this time neither UE 32 nor PC 12 is communicating with UMTS network 23.

[0020] The user of both PC 12 and UE 32 turns on UE 32 and establishes a connection with the UMTS network 23, at, S4, S5 and S6. The user then decides to trigger a handoff from PC 12 to the UE 32 at S7 and communicates this handoff request, at S8, to the WLAN network 14. WLAN network 14, at S9, transmits an SIP message, which may either take the form of a SIP handoff message or a SIP invite accompanied with either a target IP address or an email address or a telephone number. This is conveyed through IP network 18, at S10, to service server 22. Service server 22 transmits an SIP 200 (OK) message, at S11, to acknowledge the handoff (HO) message.

[0021] WLAN-equipped PC 12, receives the SIP 200 OK acknowledgement and, at S12, sends an SIP acknowledgement (ACK) to service server 22. Service server 22 transmits an SIP invite setting forth a list of media types, IP addresses, bit rates, codecs and the like, at S13 which, in turn, is conveyed through IP network 18 to UMTS network 23 at S14 and, in turn, from UMTS network 23 to UE 32, at S15. UE 32, upon receipt of the SIP invite, at S16, transmits an SIP 200 OK message acknowledging the acceptable media types, codecs, bit rate and IP address. This is transferred through UMTS network 23 to IP network 18 at S17, the IP network 18 conveying this message to service server 22, at S18. Service server 22, upon receipt of the SIP 200 OK from UE 32, at S19, conveys an SIP acknowledge (ACK) to UE 32, thereby completing the handoff of the real time session from the WLAN - capable PC 12 to UE 32, the communication of the real time session now being established between UE 32 and a given source through UMTS network 23, at S20, network 23 conveying this two-way communication to IP network 18 at S21 and IP network 18 conveying this two-way communication between IP network 18 and service server 22, at S22. The user terminates the session between PC 12 and WLAN network 14, at S23.

[0022] Figure 3 shows the manner in which a handoff from a PC 12 to a UE 32 is triggered from the UMTS network.

[0023] Initially, it is assumed that the real time multi-media session, which may be voice over internet protocol (VoIP) or video, is presently taking place as represented by the two-way communication S1 between PC 12 with WLAN card 13 and WLAN network 14 as represented by step S1, two-way communication of this session between WLAN network 14 and IP network 18 shown at S2 and two-way communication between IP network 18 and service server 22, being shown at S3. It is assumed that the user wishes to perform a handoff from PC 12 to UE 32. This is initiated by turning on UE 32, at S4, so as to connect UE 32 to the UMTS network as shown at S5 and to the IP network 18, as shown at S6.

[0024] Once the connection with UE 32 is established and the user decides to trigger a handoff to UE 32, at S7, the UE 32, at S8 sends an SIP message which may either be a new SIP handoff message or an SIP invite message with new information elements to identify the existing session. This message is transferred through UMTS network 23 to IP network 18, at S9, and thereafter to service server 22, at S10. Service server 22, upon receipt of the SIP message, transmits an SIP 200 OK to acknowledge the HO message which is conveyed, at S11, to IP network 18 which then conveys this message, at S12 to UMTS network 23, which, in turn conveys the SIP 200 OK message to UE 32 at S13.

[0025] UE 32, at S14, responds to the SIP 200 OK message by sending an SIP acknowledge to the service server 22 thereby establishing the real time session, which originally included PC 12 as a participant, to UE 32 as shown at S15, S16 and S17. It should be noted that steps S15, S16 and S17 are substantially the same as steps S20, S21 and S22 shown in Fig. 2.

[0026] After completing the handoff, service server 22, at S18 transmits an SIP BYE to terminate the real time session on the WLAN network. This is conveyed to IP network 28 at step S18, which in turn conveys the message to WLAN network 14, at S19 which, in turn, conveys the message to the PC 12, at S20.

[0027] PC 12, equipped with the WLAN card 13, sends an SIP 200 OK response to acknowledge the termination, which response is conveyed to WLAN network 14 at S21 and is, in turn, conveyed to IP network 18 at S22. The IP

network 18, in turn, conveys the SIP 200 OK message to service server 22 at S23. Upon receipt of this message, the service server 22 sends an SIP acknowledge (SIP ACK) which is initially conveyed to IP network 18, at S24, which transfers the SIP ACK message to WLAN 14 at S25, WLAN network 14 transferring the SIP ACK message to PC 12 with WLAN card 13, at S26.

[0028] Making reference to Fig. 4, in which handoff is triggered from the WLAN network 14, it is assumed that there is a real time session between UE 32 and a remote party which is represented as a real time session in which UE 32 communicates with UMTS network 23 shown at S1, UMTS network 23 communicating with IP network 18, shown at S2, the IP network 18, in turn providing the two-way communication between the UE 32 and a called subscriber through service server 12, shown at S3.

[0029] The user, at S4, turns on PC 12 and establishes a connection with the WLAN network, at S5, and IP network 18, at S6. The user then decides to trigger a handoff to the PC 12, at S7, and communicates an SIP handoff request, at S8, to the IP network 18, and service server 22, at S9. The SIP message, may either take the form of a SIP handoff message or a SIP invite accompanied with either a target IP address or an email address or a telephone number. This is conveyed through IP network 18, at S9, to service server 22. Service server 22 transmits an SIP 200 (OK) message to PC 12, at S10, to acknowledge the handoff (HO) message. WLAN-equipped PC 12, receives the SIP 200 (OK) acknowledgement and, at S11, sends an SIP acknowledgement (ACK) to service server 22. Service server 22 transmits an SIP invite setting forth a list of media types, IP addresses, bit rates, codecs and the like, at S12, which, in turn, is conveyed through IP network 18 to WLAN network 14, at S13, and, in turn, from WLAN network 14 to PC 12, at S14. PC 12, upon receipt of the SIP invite, at S15, transmits an SIP 200 OK message to WLAN 14 acknowledging the acceptable media types, codecs, bit rate and IP address. The SIP 200 OK is transferred to IP network 18 through WLAN network 14, at S16, and through IP network 18 to server 22, at S17. Service server 22, upon receipt of the SIP 200 OK from PC 12, at S18, conveys an SIP acknowledge (ACK) to WLAN 14 and

then to PC 12, through WLAN network 14, at S19, thereby completing the handoff of the real time session from the UE 32 to the WLAN - capable PC 12. The communication of the real time session is thus established between PC 12 and a given source through WLAN network 14 and IP network 18. The two-way communication is between WLAN network 14 and PC 12 at S20, IP network 18 at S21, and between IP network 18 and service server 22, at S22. The user may terminate the session on WLAN 14, at step S23.

[0030] Figure 5 shows the manner in which a handoff from a UE 32 to a PC 12 is triggered from the UMTS network 23.

[0031] Initially, it is assumed that the real time multi-media session, which may be voice over internet protocol (VoIP) or video, is presently taking place as represented by the two-way communication between UE 32 and UMTS network 23 as represented by step S1, two-way communication of this session between UMTS network 23 and IP network 18 shown at S2 and the two-way communication between IP network 18 and service server 22 being shown at S3. It is assumed that the user wishes to perform a handoff from UE 32 to PC 12. This is initiated by turning on PC 12, at S4, so as to connect PC 12 to the WLAN network 14, as shown at S5, and to the IP network 18, as shown at S6.

[0032] Once the connection with PC 12 is established and the user decides, at S7, to trigger a handoff to PC 12, the UE 32, at S8, sends an SIP message which may either be a new SIP handoff message or an SIP invite message with new information elements to identify the existing session. This message is transferred through network 23 to IP network 18, at S9, and thereafter to service server 22, at S10. Service server 22, upon receipt of the SIP message, transmits an SIP 200 OK message to acknowledge the HO message which is conveyed, at S11, to IP network 18 which then conveys this message, at S12, to WLAN network 14, which, in turn conveys the SIP 200 OK message to PC 12 at S13.

[0033] PC 12, at S14, responds to the SIP 200 OK message by sending an SIP acknowledge (ACK) to the service server 22 through WLAN network 14, at S14, IP network 18, at S15 and then from IP network 18 to service server 22 at

S16, thereby establishing the real time session, which originally included UE 32 as a participant, and is now handed off to PC 12 as shown at S17, S18 and S19.

[0034] Service server 22, at S20, sends an SIP BYE to IP network which conveys it to UMTS network 23 at S21, which at S22 conveys it to UE 32. UE 32 sends an SIP 200 OK response to acknowledge the termination, which response is conveyed to UMTS network 23 at S23 and is, in turn, conveyed to IP network 18 at S24, which, in turn, conveys the SIP 200 OK message to service server 22 at S25. Upon receipt of this message, the service server 22 sends an SIP acknowledge (SIP ACK) which is initially conveyed to IP network 18, at S26, which transfers the SIP ACK message to UMTS 23, at S27, UMTS network 23 transferring the SIP ACK message to UE 32, at S28.

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CLAIMS

What is claimed is:

1. A method for handoff of a real-time session from a first type of wireless device to a second type of wireless device different from said first type of wireless device wherein said first type of wireless device conducts a real time session through a first type of network and said second type of wireless device is capable of conducting a real time session through a second type of network different from said first type of network, comprising:

said second type of wireless device being activated to initiate a handoff to said first type of wireless device;

said second type of wireless device responsive to activation, establishing communication with said second type of network;

said second type of wireless device conveying a session initiation protocol (SIP) message to said second type of network requesting a handoff (HO) from said first to said second type of wireless device;

said second type of network, responsive to said SIP message, transmitting to said second type of wireless device acceptance of said HO request;

said second type of wireless device responsive to said acceptance message sending an SIP acknowledgement (ACK); and

said handoff being completed by said second type of network whereby said real time session continues with the first type of wireless device being replaced by second type of wireless device.

2. The method of claim 1 wherein said second type of network, responsive to said SIP ACK, transmits a terminate signal to said first type of wireless device.

3. The method of claim 2 wherein said first type of wireless device, responsive to receipt of the terminate message of said real time session, sends an acknowledge message.

4. The method of claim 3 wherein said second type of network responsive to said message acknowledging the termination received from said first type of wireless device sends an SIP ACK to said first type of wireless device.

5. The method of claim 3 wherein said first type of wireless device terminates its participation in said real-time session after sending said acknowledge message.

6. Apparatus for handoff of a real-time session from a first type of wireless device to a second type of wireless device different from said first type of wireless device wherein said first type of wireless device conducts a real time session through a first type of network and said second type of wireless device is capable of conducting a real time session through a second type of network different from said first type of network, comprising:

said second type of wireless device having means to initiate a handoff to said first type of wireless device when activated;

means responsive to activation for establishing communication with said second type of network;

means for conveying a session initiation protocol (SIP) message to said second type of network requesting a handoff (HO) from said first to said second type of wireless device;

said second type of network comprising:

means for responsive to said SIP message for transmitting to said second type of wireless device acceptance of said HO request; and

said second type of wireless device comprising:

means responsive to said acceptance message for sending an SIP acknowledgement (ACK);

whereby said handoff is completed by said second type of network, said real time session continuing with the first type of wireless device being replaced by the second type of wireless device.

7. The apparatus of claim 6 wherein said second type of network further comprises:

means responsive to said SIP ACK for transmitting a terminate signal to said first type of wireless device.

8. The apparatus of claim 7 wherein said first type of wireless device further comprises:

means responsive to receipt of the terminate message of said real time session, for sending an acknowledge message.

9. The apparatus of claim 8 wherein said second type of network further comprises:

means responsive to said message acknowledging the termination received from said first type of wireless device for sending an SIP ACK to said first type of wireless device.

10. The apparatus of claim 8 wherein said first type of wireless device further comprises:

means for terminating its participation of said first type of wireless device in said real-time session after sending said acknowledge message.

11. The apparatus of claim 6 wherein said first type of network is one of a wireless local area network (WLAN) and a wireless wide area network (WWAN).

12. The apparatus of claim 6 wherein said second type of network is one of a wireless local area network (WLAN) and a wireless wide area network (WWAN).

13. The apparatus of claim 11 said first type of wireless network further includes an access point (AP).

14. The apparatus of claim 11 said second type of wireless network further includes an access point (AP).