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(71) Applicant *(for all designated States except US)*: **SANTERA SYSTEMS, INC** [US/US]; 3605 EAST PLANO PARKWAY, Suite 100, Plano, TX 75074 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **HE, Yong** [US/US]; 3113 Spring Grove Dr., Plano, TX 75025 (US). **LEE, Weijun** [CA/US]; 3209 Deep Springs Drive, Plano, TX 75025 (US). **SHEN, Mansong** [CN/US]; 4160 Kite Meadow Drive, Plano, TX 75074 (US).

(74) Agent: **HUNT, Gregory, A.**; JENKINS, WILSON, TAYLOR & HUNT, P.A., SUITE 1200, UNIVERSITY TOWER, 3100 Tower Boulevard, Durham, NC 27707 (US).

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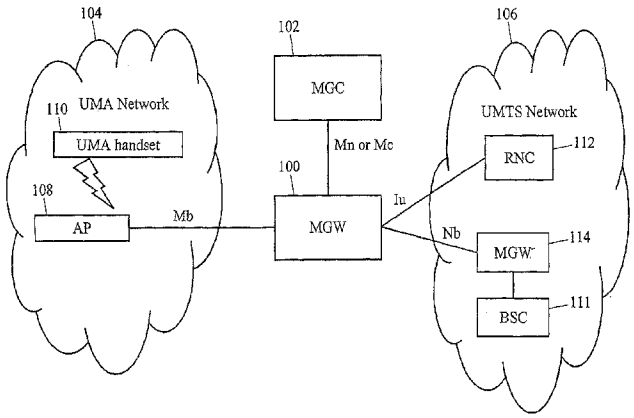
(54) Title: METHODS, SYSTEMS, AND COMPUTER PROGRAM PRODUCTS FOR PROVIDING TRANSCODER FREE OPERATION (TRFO) AND INTERWORKING BETWEEN UNLICENSED MOBILE ACCESS (UMA) AND UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS) CALL LEGS USING A MEDIA GATEWAY



(57) Abstract: Methods, systems, and computer program products for establishing transcoding free connections between UMA and UMTS call legs are disclosed. According to one method, a media gateway determines whether codec configurations used by UMA and UMTS legs of a call are compatible. In response to determining that the configurations are compatible, media gateway determines whether rate control is necessary to establish a transcoding free connection. In response to determining that rate control is necessary, the media gateway issues rate control requests on the UMA and UMTS legs as appropriate. The media gateway determines whether the rate control requests are successful. In response to determining that the requests are successful, the media gateway establishes a transcoding free connection between the UMA and the UMTS legs of the call.

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AMENDED CLAIMS

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What is claimed is:

1. A method for establishing a transcoding free connection in a media gateway for a connection having an unlicensed mobile access (UMA) leg and a universal mobile telecommunications service (UMTS) leg, the method comprising:
   (a) determining whether codec configurations used by different legs of a UMA-UMTS connection are compatible;
   (b) in response to determining that the codec configurations are compatible, determining whether rate control is required to establish a transcoding free connection;
   (c) in response to determining that rate control is required, issuing a rate control request to at least one of the UMTS and UMA legs;
   (d) determining whether the rate control request is successful; and
   (e) in response to determining that the rate control request is successful, establishing a transcoding free connection between the UMTS and the UMA leg in the media gateway.
2. The method of claim 1 wherein determining whether codec configurations used by different legs of a UMA-UMTS connection are compatible includes examining a call setup signaling message associated with the UMA-UMTS connection.
3. The method of claim 1 wherein issuing at least rate control request includes issuing a rate control request to the UMTS leg requesting that the UMTS leg start sending voice packets encoded at a rate corresponding to a decoding rate of the UMA leg.
4. The method of claim 3 wherein determining whether the rate control request is successful includes monitoring voice packets received from the UMTS leg to determine whether the encoding rate used by the UMTS leg changes within a timeout period.
5. The method of claim 3 wherein determining whether the rate control request is successful includes determining whether an acknowledgment is received from the UMTS leg.

6. The method of claim 1 wherein issuing a rate control request on at least one of the UMTS and UMA legs includes sending a codec mode request (CMR) over the UMA leg.
7. The method of claim 6 wherein determining whether the rate control request is successful includes monitoring an encoding rate of packets received from the UMA leg and determining whether the requested rate is achieved within a timeout period.
8. The method of claim 7 comprising, in response to determining that the requested rate is achieved, sending an acknowledgement to the UMTS leg.
9. The method of claim 7, comprising, in response to determining that the requested rate is not achieved, sending a negative acknowledgement to the UMTS leg.
10. The method of claim 1 wherein establishing a transcoding free connection in the media gateway includes connecting the UMTS leg to the UMA leg over an Ethernet switching fabric within the media gateway.
11. The method of claim 1 wherein establishing a transcoding free connection in the media gateway includes connecting the UMTS leg to the UMA leg over an asynchronous transfer mode (ATM) switching fabric within the media gateway.
12. The method of claim 1 comprising maintaining the transcoding free connection between the UMA leg and the UMTS leg.
13. The method of claim 12 wherein maintaining the transcoding free connection includes performing redundancy reconciliation for redundant voice frames received from the UMA leg,
14. The method of claim 13 wherein performing redundancy reconciliation for voice frames received over the UMA leg includes receiving redundant frames over the UMA leg and sending current frames to the UMTS leg.
15. The method of claim 13 wherein maintaining the transcoding free connection includes performing redundancy reconciliation for frames received over the UMTS leg.

16. The method of claim 15 wherein performing redundancy reconciliation for frames received over the UMTS leg includes receiving frames without redundancy over the UMTS leg, building redundant frames, and transmitting the redundant frames over the UMA leg.

17. A media gateway for establishing a transcoding free connection between unlicensed mobile access (UMA) and universal mobile telecommunications service (UMTS) legs of a connection, the media gateway comprising:

(a) at least one broadband interface for sending media packets to and from a UMA leg and a UMTS leg of a connection;

(b) a packet switching fabric for forwarding media packets between the at least one broadband interface and at least one internal processing resource of the media gateway;

(c) at least one voice server for performing voice processing functions for media packets received from the UMA leg and the UMTS leg; and

(d) a UMA-UMTS transcoder free operation controller for establishing a transcoding free connection within the media gateway between the UMA and the UMTS legs via the at least one broadband interface, the packet switching fabric, and the at least one voice server.

18. The media gateway of claim 17 wherein the UMA-UMTS transcoder free operation controller is configured to examine a call setup signaling message associated with the UMA-UMTS connection to determine whether codec configurations used by different legs of a UMA-UMTS connection are compatible.

19. The media gateway of claim 18 wherein the at least voice server is adapted to issue a rate control request to at least one of the UMA leg and the UMTS leg to establish the transcoding free connection.

20. The media gateway of claim 19 wherein the at least one voice server is adapted to issue a UMTS rate control request to the UMTS leg.

21. The media gateway of claim 20 wherein the at least one voice server is adapted to monitor the encoding rate being used by the UMTS leg.

22. The media gateway of claim 20 wherein the at least one voice server is adapted to monitor the UMTS leg for an acknowledgement to the rate control request.
23. The media gateway of claim 20 wherein the at least one voice server is adapted to issue a codec mode request (CMR) to the UMA leg.
24. The media gateway of claim 23 wherein the at least one voice server is adapted to monitor the encoding rate being used by the UMA leg.
25. The media gateway of claim 24 wherein the at least one voice server is adapted to send an acknowledgement to the UMTS leg in response to determining that the codec mode request on the UMA leg is successful.
26. The media gateway of claim 24 wherein the at least one voice server is adapted to send a negative acknowledgement to the UMTS leg in response to failing to detect a change in the encoding rate on the UMA leg.
27. The media gateway of claim 18 wherein the at least one voice server is adapted to maintain the transcoding free connection.
28. The media gateway of claim 27 wherein, in maintaining the transcoding free connection, the at least one voice server is adapted to perform redundancy reconciliation between the UMA and UMTS legs.
29. The media gateway of claim 28 wherein, in performing the redundancy reconciliation, the at least one voice server is adapted to build redundant voice frames to be transmitted over the UMA leg based on packets received over the UMTS leg.
30. The media gateway of claim 28 wherein, in performing the redundancy reconciliation, the at least one voice server is adapted to receive redundant voice frames from the UMA leg and transmit current voice frames over the UMTS leg.
31. A computer program product comprising computer executable instructions embodied in a computer readable medium for performing steps comprising:
    (a) determining whether codec configurations used by different legs of a unlicensed mobile access-universal mobile

telecommunications service (UMA-UMTS) connection are compatible;

(b) in response to determining that the codec configurations are compatible, determining whether rate control is required to establish a transcoding free connection;

(c) in response to determining that rate control is required, issuing a rate control request to at least one of the UMTS and UMA legs;

(d) determining whether the rate control request is successful; and

(e) in response to determining that the rate control request is successful, establishing a transcoder free connection between the UMTS leg and the UMA leg in the media gateway.