mode" for aggregated traffic meaning eNB PDCP passes PDUs but doesn't apply normal operations of LTE PDCP to the traffic. At item **5** there is EPS Bearer reconfigure message to an eNB that can be used to terminate aggregation. NOTE: Although packet routing between LWAC and EPC based Dedicated EPS bearer is used as an example, aggregation may be enabled for other communication instances as well. For example aggregating traffic related to APN (Access Point Name), applying 5-tuples (IP address, TCP/UDP port, . . .) in determining which traffic is aggregated, redirecting IP packets belonging to specific application or TCP flow to one of the radios etc.

[0045] In addition example exemplary operations can be described as follows:

[0046] Aggregation Activation

[0047] When UE attaches to LTE network or when UE or network decides to establish an EPS bearer/session or Dedicated EPS bearer, MME and eNB communicate to activate relevant bearers over S1 interface. In accordance with the exemplary embodiments the term S1 interface or protocol is non-limiting and the operations associated with the S1 interface and/or protocol in this paper may be performed using any interface between network elements which is relaying user data. During bearer establishment, eNB may decide to use LTE/Wi-Fi aggregation. The decision may be based on operator configured policy, QoS characteristics, UE radio access capability, network performance (like load), Wi-Fi availability under cell area, application awareness and/or characteristics etc.

[0048] In case eNB decides to activate LTE/Wi-Fi aggregation, before responding to MME eNB communicates with LWAC. The eNB sends e.g. QoS, UE (e.g. capability), traffic and RF/load (of LTE and Wi-Fi if available) related parameters to LWAC and asks for aggregation activation. In case LWAC accepts aggregation activation, LWAC sends to eNB transport and TEID (GTP Tunnel End point ID (identifier)). In addition, LWAC and eNB may negotiate internal details for supporting aggregation, like eNB address information used by LWAC when delivering PDCP/RLC PDU to eNB, whether to use eNB PDCP or RLC API for packets etc. LWAC may also deny use of aggregation. For example LWAC may be implemented as virtualized SW on COTS HW and if there are already too many aggregation instances ongoing the LWAC may not have enough resources to support the requested new aggregation. In such a case eNB may continue transmission over LTE only or redirect the UE to use Wi-Fi (e.g. by using 3GPP release 12 WLAN Radio Interworking functionality). Also LWAC may know through prior communication the load of Wi-Fi AP/network and thus reject support for aggregation towards specific AP.

[0049] After communicating with LWAC eNB responds to MME. In case aggregation is to be used for the traffic related to the bearer being activated, eNB provides LWAC transport and TEID information to MME which provides the information further to SGW. This makes SWG to send user data packets related to the bearer to LWAC instead of eNB.

[0050] NOTE: Decision to use aggregation may be done even if it's known that currently UE doesn't have Wi-Fi available or for example available Wi-Fi is congested and thus UE has to wait for use of the Wi-Fi. By knowing cell area has Wi-Fi coverage preparations to perform aggregation may be done beforehand and LWAC starts distributing traffic between LTE and Wi-Fi only when UE has both radios available. Until Wi-Fi is available or decided to be used, for example LWAC may perform LTE PDCP functionality and send PDUs to eNB RLC to process further.

[0051] In addition, LTE/Wi-Fi aggregation may be activated during ongoing data transmission where eNB is already communicating with the UE. An S1 AP protocol included with the communications can contain for example a Path Switch procedure allowing eNB to change a data communication end point. Thus, in case eNB decides to activate aggregation function, eNB can utilize the Path Switch to notify SGW (via MME) he transport and TEID information of LWAC causing all/selected traffic to be transmitted via LWAC.

[0052] Aggregation Operation

[0053] In the following the operation of LWAC, eNB and Wi-Fi (Controller and/or AP) are described as part of LTE/Wi-Fi aggregation operation.

[0054] LWAC distributes traffic between LTE and Wi-Fi radios. There are several potential protocol and functional divisions between eNB, LWAC and Wi-Fi. An example scenario including the exemplary embodiments of the invention is described.

[0055] As previously and similarly stated with regards to FIG. **5** describes a potential scenario for LTE/Wi-Fi aggregation where LTE PDCP (with some enhancements on top of or linked to existing PDCP) is used commonly with LTE and Wi-Fi radios. Below, PDCP LTE eNB may use a normal existing LTE RLC protocol. Wi-Fi has RLC' which performs necessary functions allowing LTE PDCP to operate, for example notifies PDCP blocks which couldn't be transmitted over Wi-Fi radio (e.g., lost blocks etc. as LTE RLC is expected to provide reliable radio transmission for selected traffic).

[0056] In the example an eNB is configured to operate in a mode where eNB PDCP is not used for aggregated traffic at all and eNB LTE RLC provides an API to interact directly with LWAC PDCP. Another option is to route LWAC PDCP packets via eNB PDCP acting in (nearly) transparent mode. For example a UE may have bearers using aggregation (Initial/Dedicated bearer) and bearers not using aggregation (other (Initial/Dedicated bearer). Or UE may have aggregation applied only to downlink or uplink traffic. For bearer(s) not using aggregation, an existing eNB PDCP may be used normally. Having knowledge of aggregated traffic as well the eNB PDCP may be able to optimize its' operation (e.g., by just staying in sync of what's going on in the aggregated traffic and following LWAC PDCP control information etc.). For example eNB PDCP may monitor LWAC managed PDCP PDU sequence numbering and eNB RLC queue status (if available) to determine how much traffic goes over LTE and Wi-Fi (gaps in consequent sequence numbering reveal the PDU has been assigned to Wi-Fi) to influence on eNB scheduling decisions where feasible (together with other input, like assigned QoS profile). Aggregation works the best when used radios perform close enough equally well. Likewise Wi-Fi may use the RLC(') to monitor PDCP PDU sequence numbering that may be used to influence traffic prioritization within the Wi-Fi AP (for example by affecting Wi-Fi AP scheduling decisions part of Wi-Fi Multimedia). LWAC may also distribute/share performance/scheduling information across used radios in order to improve sync between the two radios and similar performance for PDUs related to a bearer. Otherwise if performance of the too radios is too different, receiving PDCP operation is not optimum as PDUs arrive out of sync and receiving PDCP may not be able to tell efficiently