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Motivation for LTE-WiFi Aggregation

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Motivation

- Current WLAN offloading solutions are useful for service & policy management but not efficient for radio and system performance:
  - No framework to jointly optimize radio link resources based on channel & load conditions
  - They also do not allow tight control of WLAN offloading due to device centric methods
- Other device-based solutions for Cellular+WiFi aggregation create fragmentation & remove operator value:
  - E.g. HTTP Aggregation or Multipath TCP
  - See next slide
- **RAN-level Aggregation of LTE and WiFi provides many benefits**:
  - Dynamic allocation of resources based on radio and load conditions
  - Higher aggregate user throughput & system throughput
  - Unified network control and management of offloading and available resources (similar to LTE CA and DC)
  - Real-time load balancing
  - Minimal or no impact on core network and applications
  - RAN-level seamless handover support

E-UTRAN/WLAN Aggregation solutions (device based & operator-centric)

This is the Rel-13 proposal

RAN Aggregation Architecture

- S1-U and S1-MME are terminated at the eNB
- The interface between eNB and WLAN is left to implementation for collocated and will be standardized for non-collocated deployment:
  - The WLAN end-point of the interface is a reference point and where it is implemented (AP, AC, or another entity) is outside the scope of this SI/WI (and 3GPP in general)
  - Many features of the interface (protocol, flow control etc.) can be based on the Dual Connectivity solution

Analysis of LTE-WiFi Aggregation

- eNB will serve as the anchor for both user (S1-U) and control (S1-MME) plane:
  - No changes to the MME and S-GW/P-GW are needed to support Aggregation
  - No new WLAN-specific CN node is needed
- The proposal is to use PDCP level aggregation of LTE and Wi-Fi, where a PDCP PDU can be served on either LTE or WiFi:
  - This does not mean that the granularity of eNB decision has to be per packet (PDCP PDU)
  - Scheduling decisions over a longer time scale (i.e. similar to bearer switching) will also be allowed
- The choice of PDCP was mainly motivated by its adoption for Dual Connectivity (DC) in Rel-12:
  - This will enable re-use of the Rel-12 standardization as well as UE and eNB implementation of DC
    - LTE-WiFi aggregation is much simpler than LTE DC since there is a single RRC and RRM at the eNB

Analysis of LTE-WiFi Aggregation cont'd

- Advantages of LTE-WiFi aggregation at the eNB:
  - Much higher system and user throughput due to real-time scheduling and the ability to use both radio links simultaneously for each data bearer, which also improves QoE
  - Control of data switching directly by the eNB by using reliable LTE control (i.e. dedicated SRB) signaling
  - Faster switching between LTE and Wi-Fi since signaling between the UE and CN is not needed
  - Better control of data delivered over WiFi via the standardized interface (e.g. flow control)
  - Improved mobility since eNB can communicate with WLAN directly over the standardized interface
    - Other LTE Handover features such as data forwarding, along with PDCP Status Reporting, can also be enabled on the interface

Analysis of LTE-WiFi Aggregation cont'd

- The following requirements will be addressed:
  - No impact on 802.11 specifications
  - Only applicable to WLAN networks deployed and controlled by operators and their partners
  - Allow discovery of other WLAN networks which do not support aggregation
    - Applicable to home and other enterprise networks
  - Improve overall system and user performance

3GPP Rel-13 proposal

- Proposing to consider both collocated and non-collocated (non-ideal backhaul between eNB and WLAN) scenarios:
  - A single solution which are applicable to both cases are targeted in RAN2
  - The main difference for non-collocated will be the additional backhaul interface between E-UTRAN and WLAN and associated control signaling and data transfer on this interface
- The SI will be RAN2-led; the work on backhaul interface and signaling for the non-collocated case will be joint with RAN3:
  - The RAN3 part will avoid duplicating work for eNB-WLAN interface which is already being studied in the Rel-13 Multi-RAT SI.
- Interaction with SA2 will happen after the SI is complete to study the co-existence with previous (Rel-12 and before) WLAN offloading solutions and other possible system aspects

Thank you

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