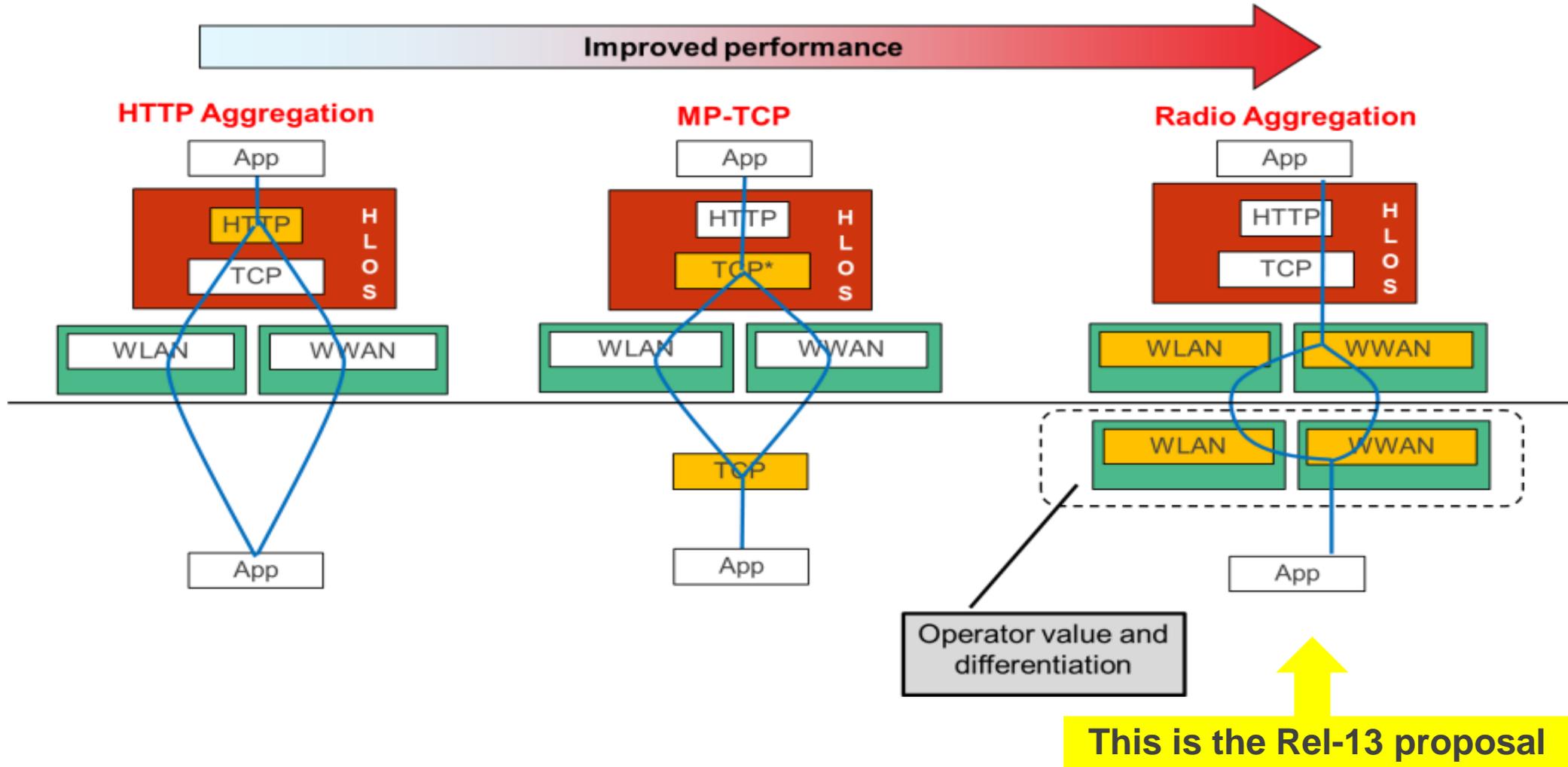

Motivation for E-UTRAN and WLAN Aggregation



Motivation

- Current CN-based 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
 - Application flows can not be aggregated on both links
 - They also do not allow tight control of WLAN offloading due to device centric methods
- ANDSF is not a useful tool for **tight** resource management (not even with R12 RAN-assisted offloading)
- 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)
 - 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)



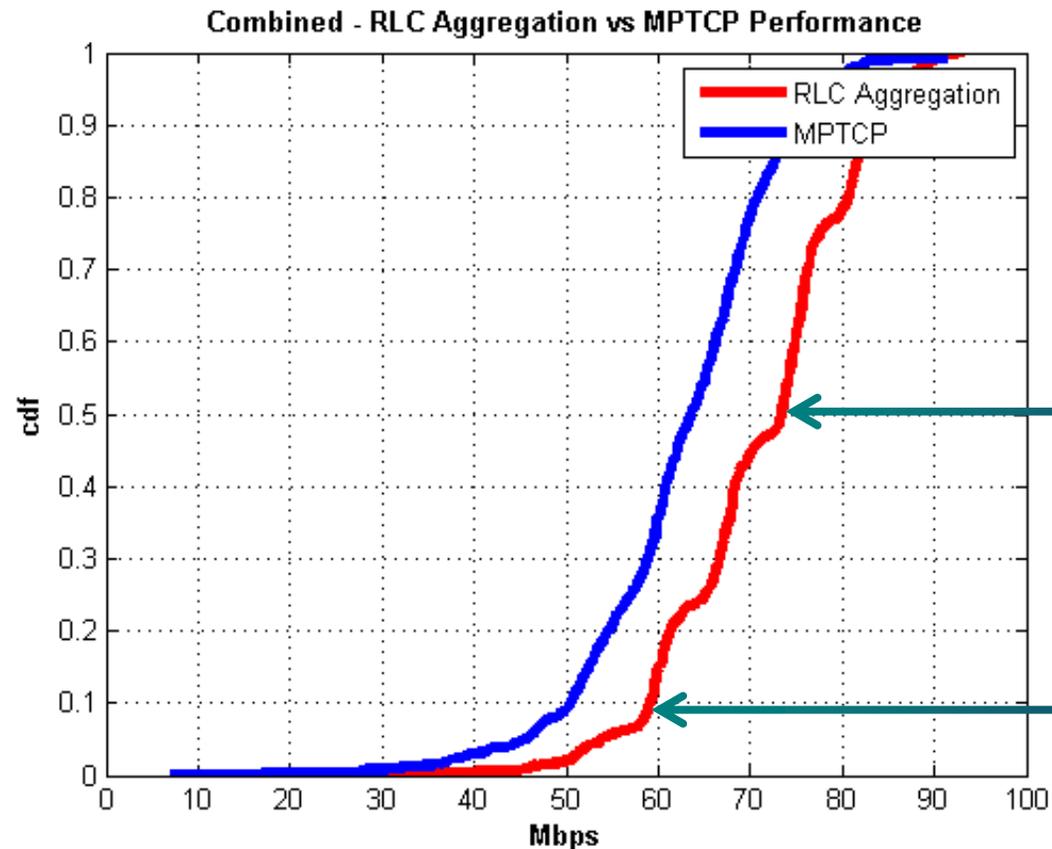
Performance Comparison of RAN aggregation to MP-TCP

- Qualcomm has been prototyping LTE-WiFi aggregation at the RLC layer:
 - The selection of RLC was due to its re-transmission and re-ordering abilities and can be considered as an upper bound for RAN aggregation performance
 - PDCP layer is another major alternative and it has some advantages due to its adoption for Dual Connectivity in Rel-12 and thus can be preferred, especially, for non-collocated deployments
- OTA tests were conducted to **compare** application level throughputs for RAN aggregation and Multi-Path TCP:
 - Multi-Path TCP can also aggregate traffic on both links and was considered as the benchmark since other CN-based offloading solutions were seen to have much lower performance from simulations
- Test Configuration
 - LTE-WiFi
 - Prototype UE and eNB: 2x2 MIMO, 10 MHz
 - Pre-commercial STA and AP: 2x2 MIMO, 20 MHz, 802.11ac
 - OTA location
 - Outdoor eNB/AP; stationary UE/STA in parked van
 - WiFi
 - Uncontrolled interference from Qualcomm intranet; channel 11 (2.4Ghz)

Performance Comparison of RAN aggregation to MP-TCP (cont.)

WiFi RSSI = -59 to -65 dBm, LTE RSRP = -80dBm, averaged over 3 days

- Significant performance improvement compared to MP-TCP was observed
- The gains are due to better ability to react to dynamic channel and load conditions

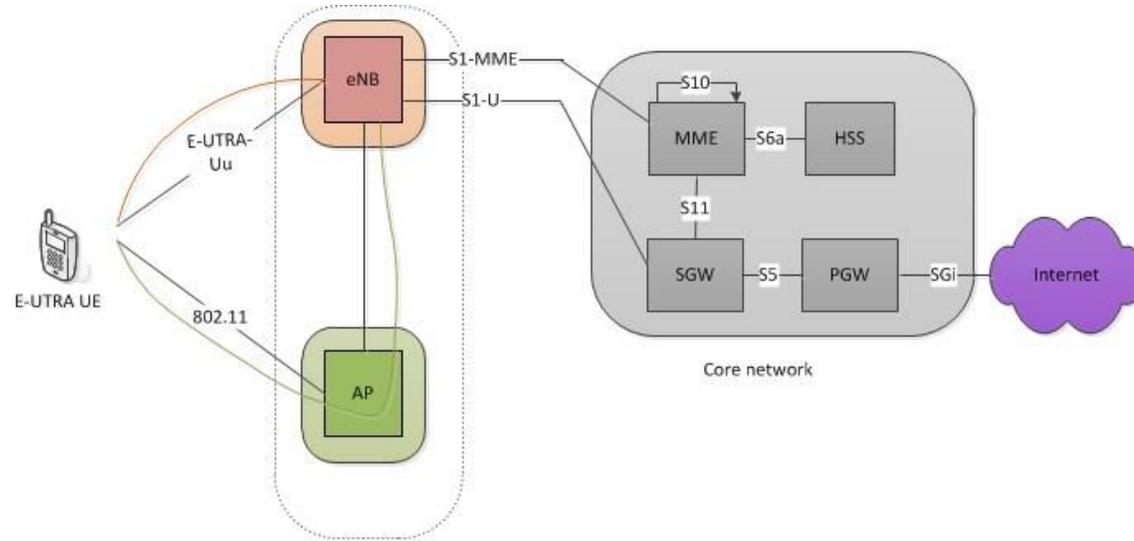


Intranet WiFi Interference
20-35 co-channel APs detected

50th Percentile
15% gain

10th Percentile
20% gain

What should the scope of the RAN2 Study item be



- The interface between eNB and WLAN (e.g. AP) is necessary for non-collocated deployment

- The SID evaluation should include the following:
 - Architectural requirements and aspects
 - Aggregation layer and performance evaluation
 - Mechanisms to identify PDU and logical channel being transported over WLAN
 - Control plane aspects (activation, deactivation, security) and mobility aspects
 - Interface between eNB and WLAN
 - Co-existence with the pre Rel-13 WLAN offloading solutions

3GPP Rel-13 proposal

- **Proposed SID in RP-141000**
- Proposing to consider both collocated and non-collocated scenarios
 - The main difference for non-collocated will be the backhaul interface between E-UTRAN and WLAN and associated control signaling and data transfer on this interface
- The SI is RAN2-led; the work on backhaul interface for non-collocated will be joint with RAN3.
- Interaction with SA2 is needed to ensure proper coordination of the work and co-existence with previous (Rel-12 and before) offloading solutions

Thank you

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