

LTE-WLAN Aggregation (LWA),  
RAN Controlled LTE-WLAN Interworking(RCLWI), and  
LTE/WLAN Radio Level Integration with IPsec Tunnel  
(LWIP) in 3GPP Release 13

Jing-Rong Hsieh, HTC

# Agenda

- Background
- LWA
- RCLWI
- LWIP

# Background

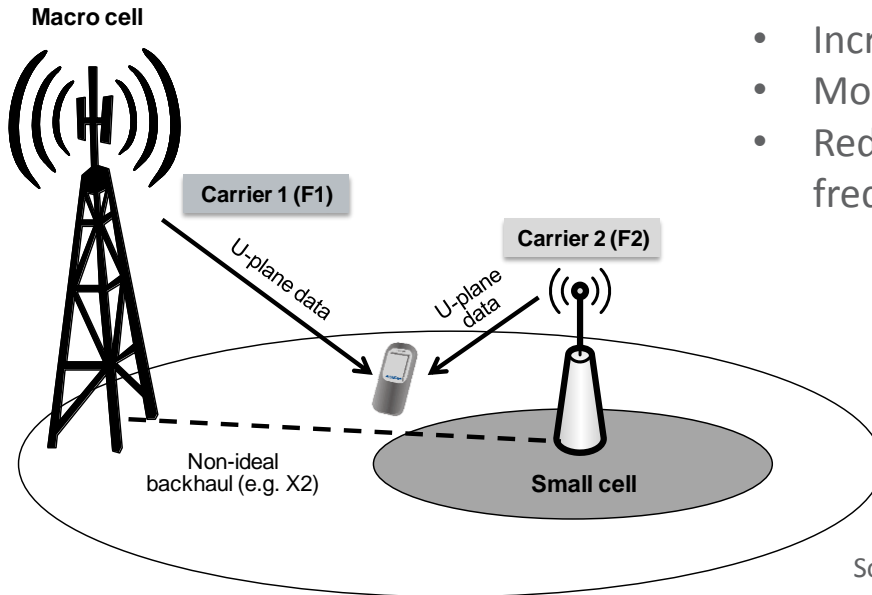
- Growing traffic demand
- Licensed + unlicensed
  - Rel-12: LTE/WLAN Interworking
  - Rel-13: LTE-WLAN Radio Level Integration and Interworking enhancement
  - Rel-13: LTE-WLAN Radio Level Integration support Legacy WLAN
  - Rel-13: Licensed-Assisted Access using LTE

# LTE-WLAN Radio Level Integration and Interworking Enhancement

*Mar. 15 - Mar. 16, WID: [RP-152213](#)*

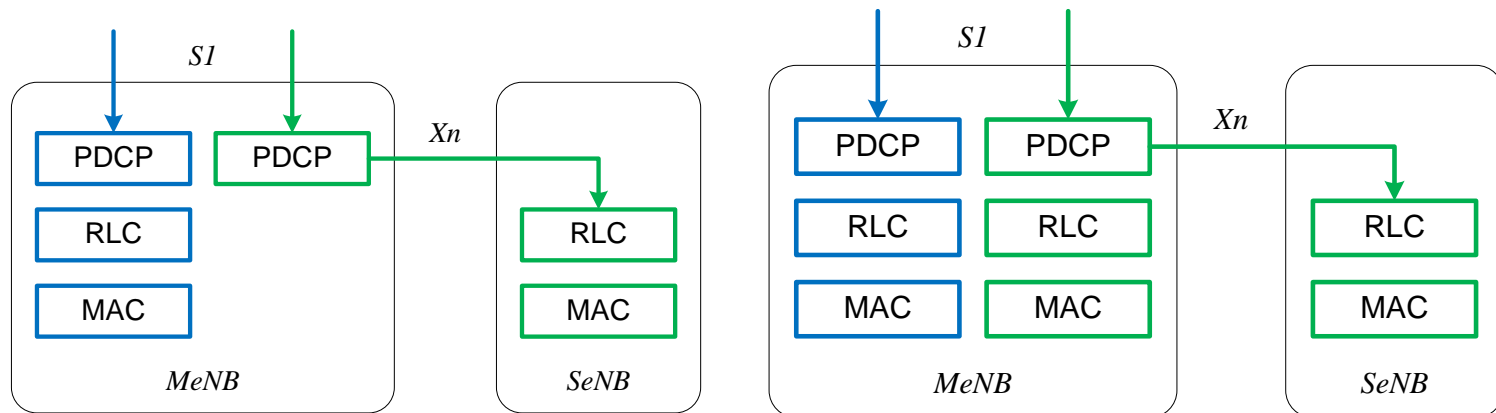
- Objective of SI/WI
  - LTE-WLAN Aggregation should be transparent to EPC.
  - Consider only WLAN nodes deployed and controlled by operators and their partners
  - Solutions for Aggregation should build upon Release-12 LTE Dual Connectivity architecture
  - Improve mobility to/from WLAN while minimizing the core network signalling
  - Improve network control of WLAN offload
  - Improve overall UE throughput by using both cellular and WLAN access

# Dual Connectivity

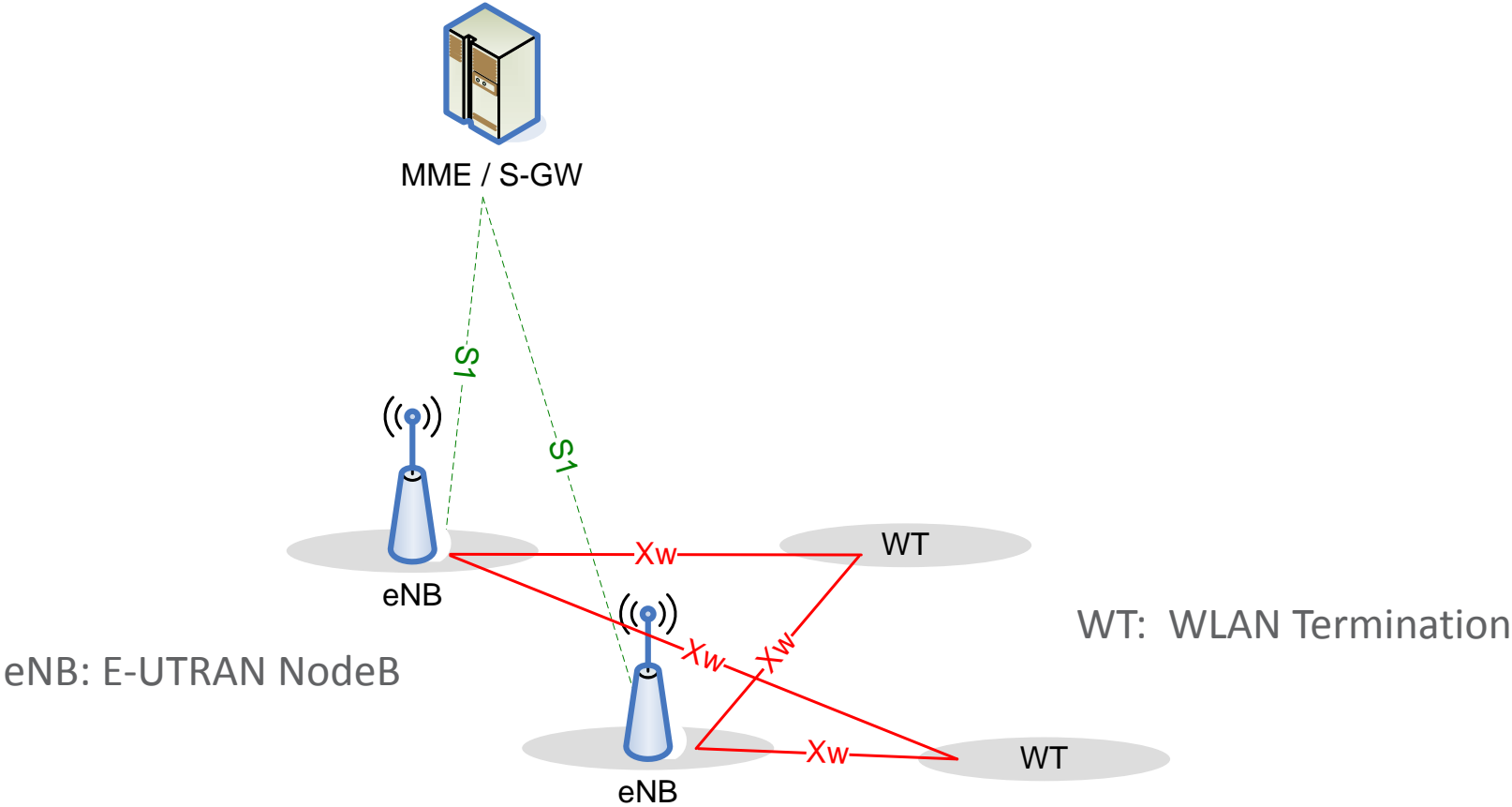


- Increase UE throughput especially for cell edge UEs
- Mobility robustness enhancement
- Reducing signaling overhead towards the CN due to frequent handover

Source: TS 36.842

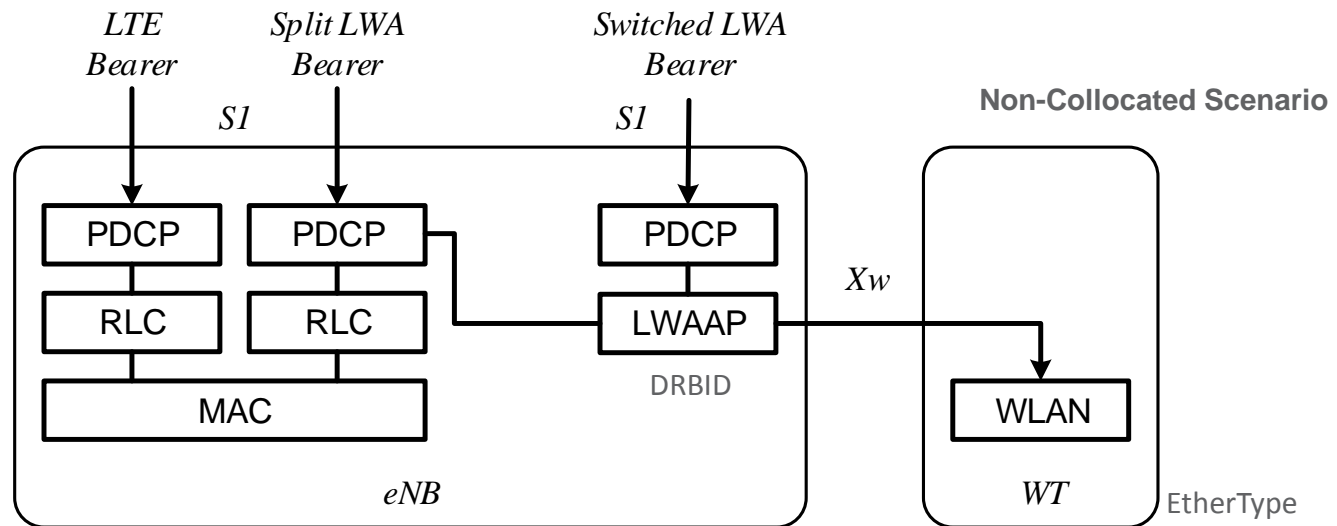
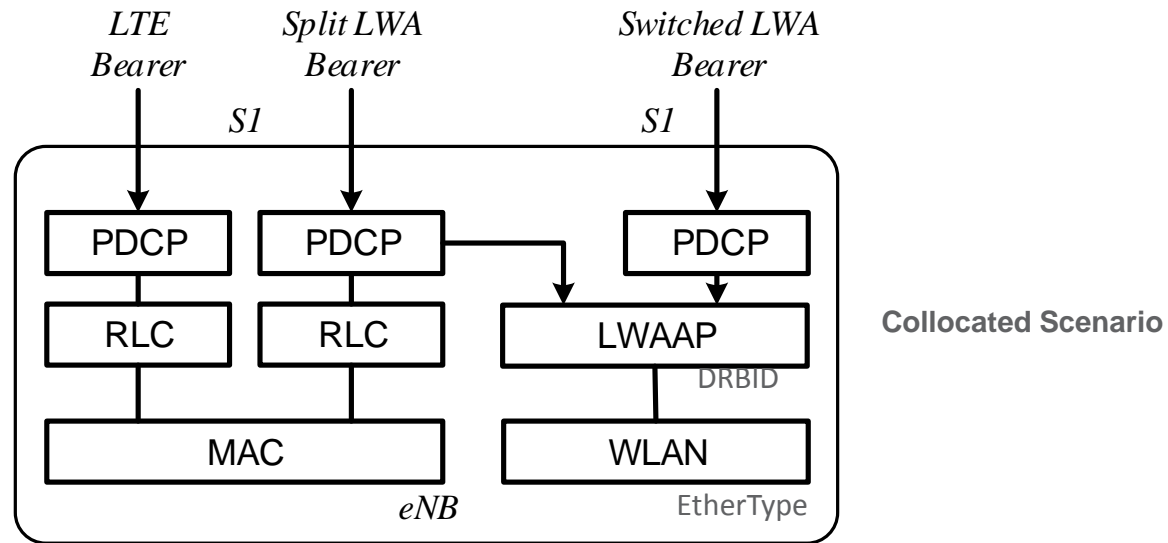


# Non-collocated LWA Overall Architecture

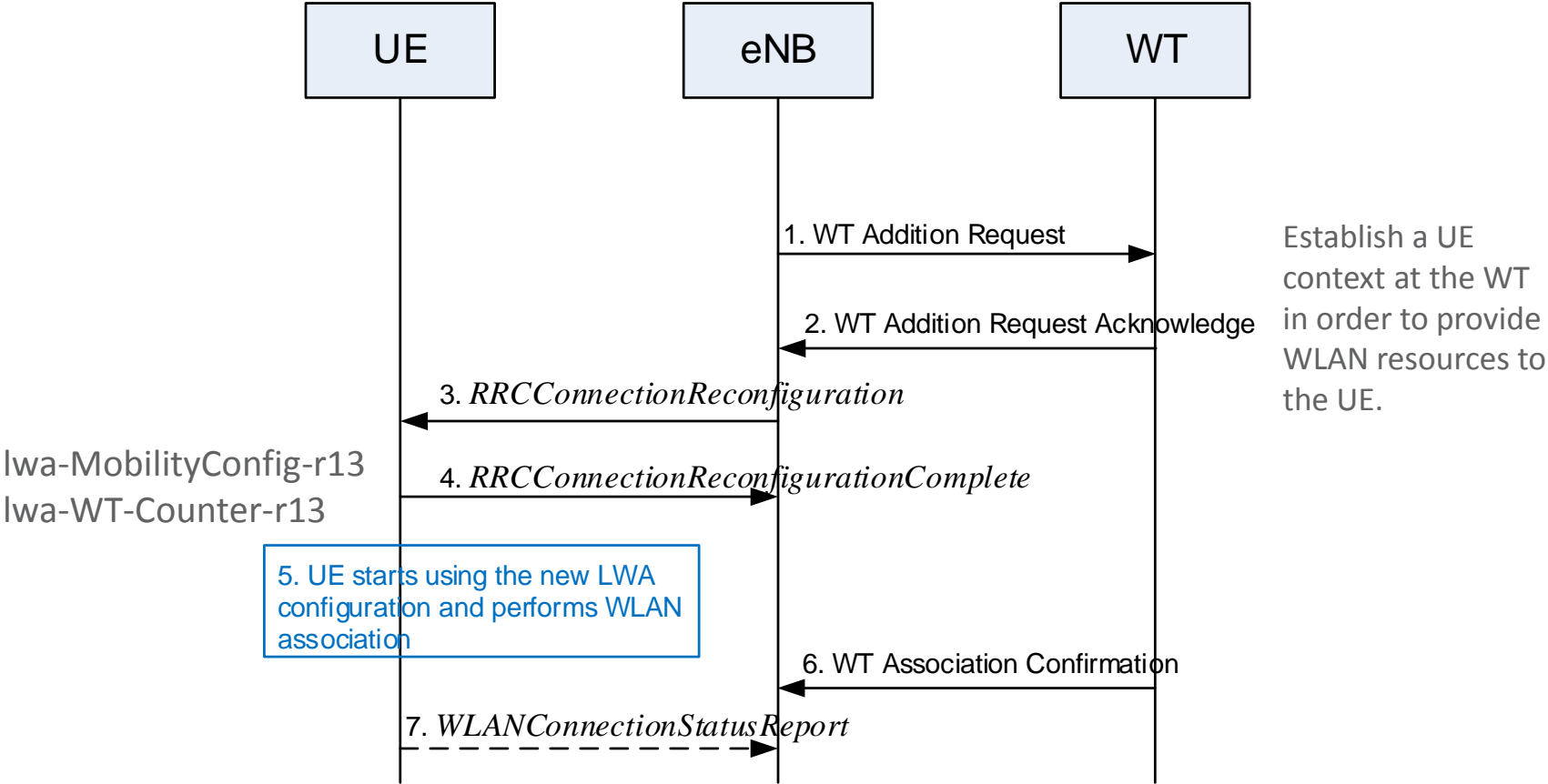


Source: TS 36.300

# LWA Radio Protocol Architecture

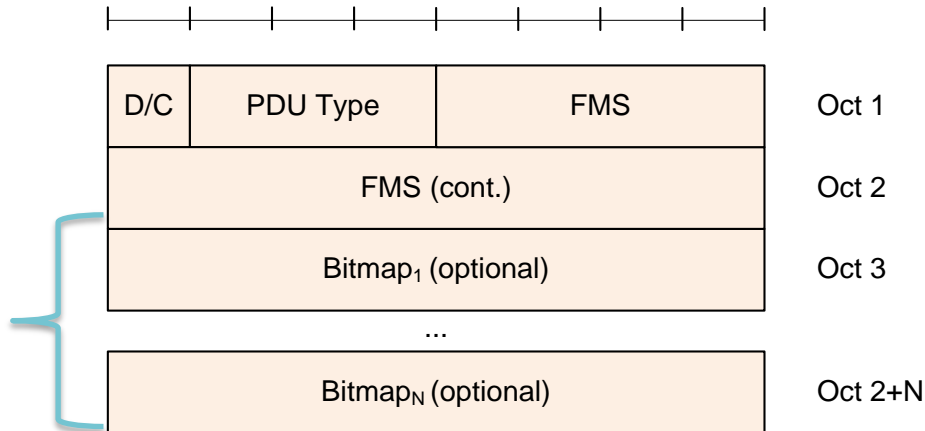


# WT Addition procedure

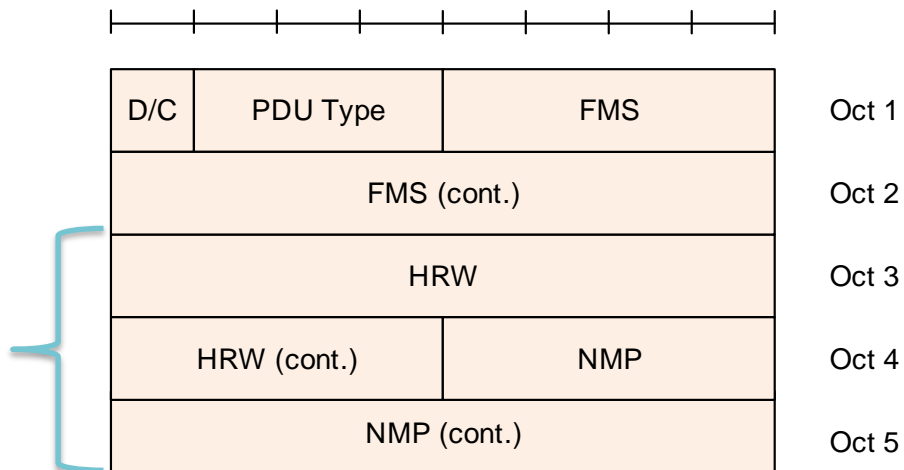




# Polled or periodical PDCP Status Reporting



PDCP Control PDU format for PDCP status report



PDCP Control PDU format for LWA status report

- First Missing PDCP SN (FMS)
- Highest successfully Received PDCP SN on WLAN link (HRW)
- Number of Missing PDCP PDUs (NMP)

# Measurement

- Measurement report triggering
  - WLAN becomes better than a threshold
  - All WLAN inside WLAN mobility set becomes worse than threshold1 and a WLAN outside WLAN mobility set becomes better than threshold2
  - All WLAN inside WLAN mobility set becomes worse than a threshold
- Measurement information elements
  - MeasObjectToAddModList
  - MeasObjectWLAN
  - MeasResults
  - QuantityConfig
  - ReportConfigInterRAT
  - WLAN-CarrierInfo
  - WLAN-Status

# WLAN Connection Status Reporting

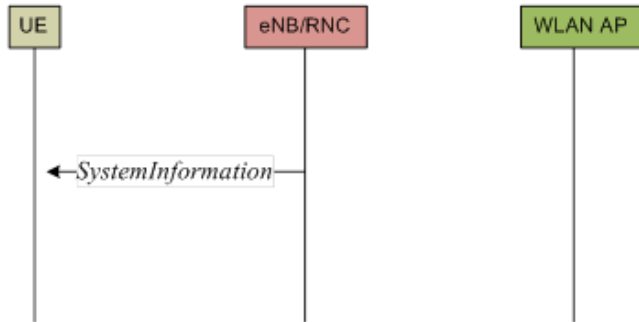
- T351 Expiry (WLAN Connection Attempt Timeout)
- WLAN Status Monitoring
  - successfulAssociation,
  - failureWlanRadioLink,
  - failureWlanUnavailable,
  - failureTimeout

# UE Capabilities

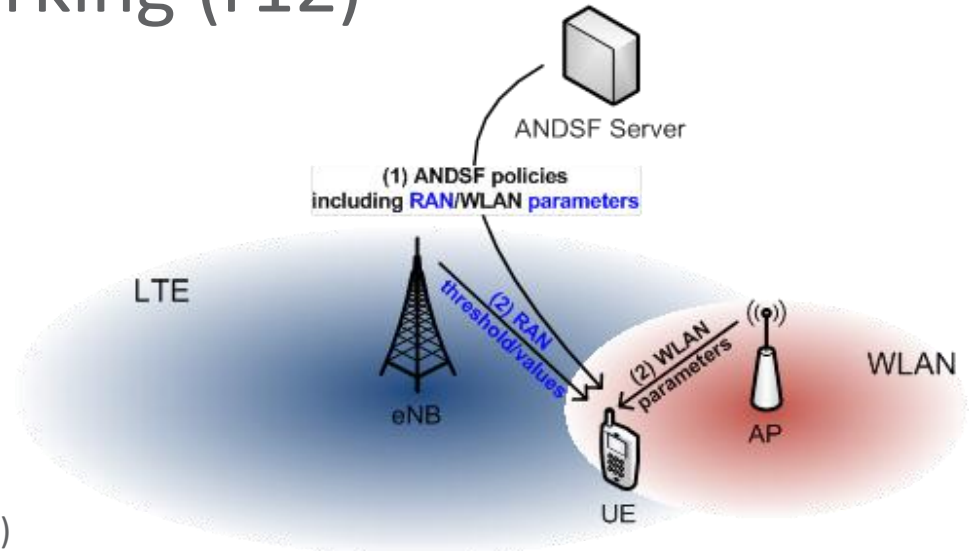
- *wlan-MeasurementReporting-r13*
- *supportedBandListWLAN*
- LWA parameters
  - *lwa-r13*
  - *lwa-SplitBearer-r13*
  - *lwa-BufferSize-r13*
- RCLWI parameters
  - *rclwi-r13*

# 37.834 Study on WLAN - 3GPP radio interworking (r12)

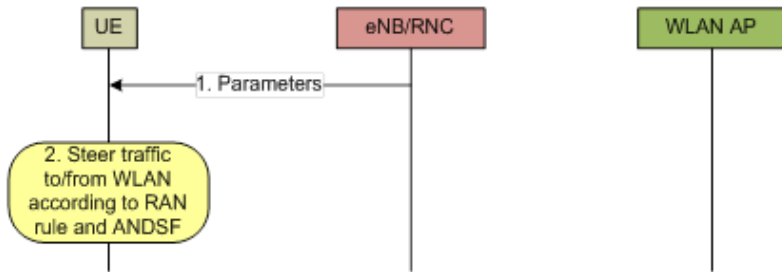
Sol. 1



broadcast signalling (and optionally dedicated signalling)

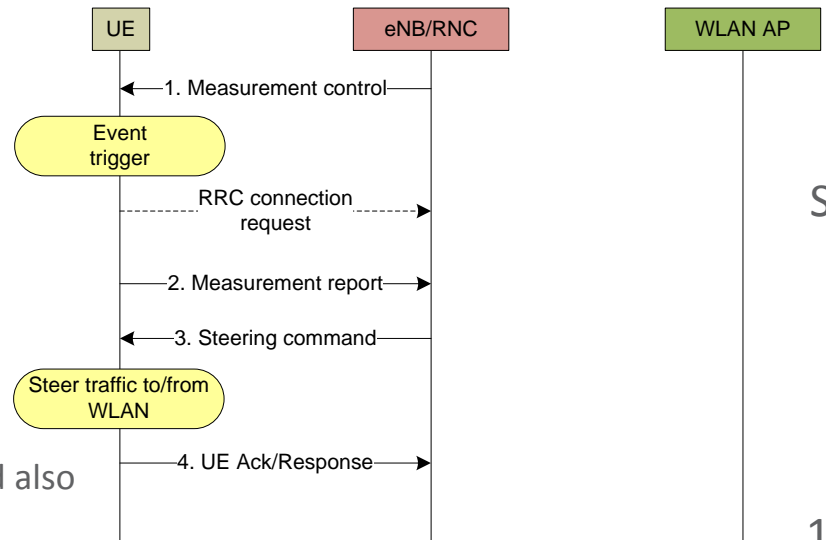


Sol. 2



dedicated and/or broadcast signalling

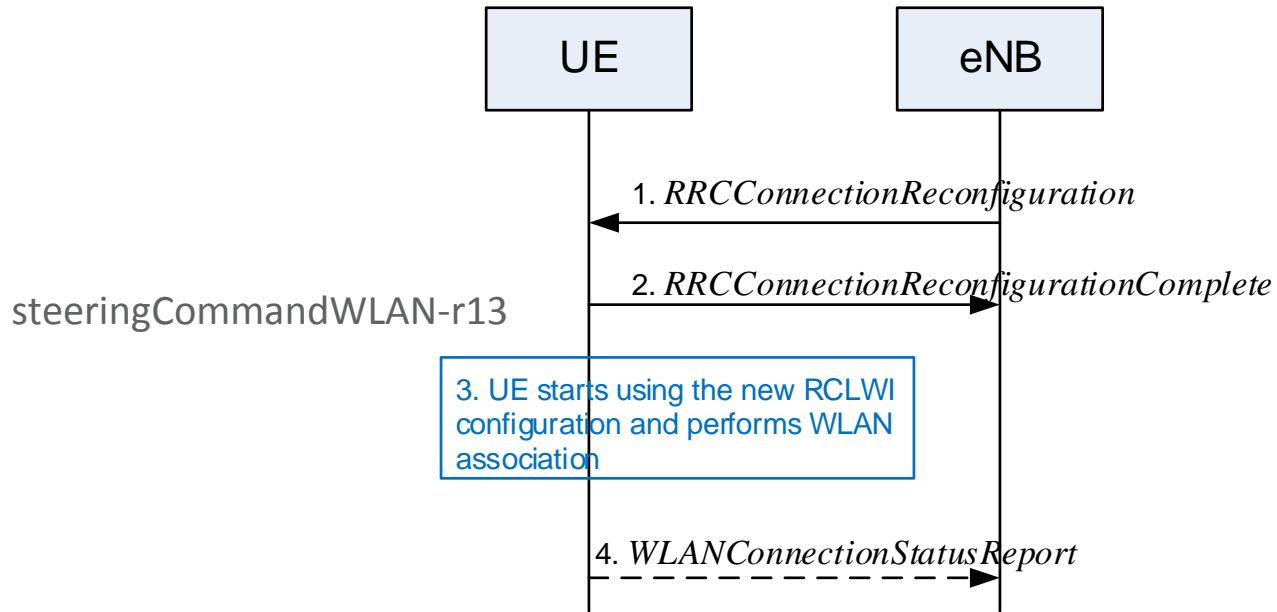
dedicated traffic steering commands, potentially based also on WLAN measurements



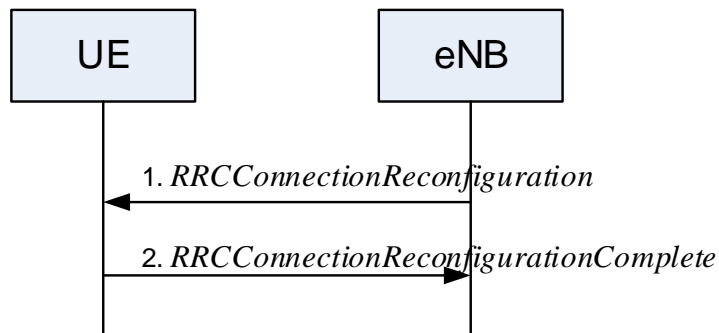
Sol. 3

# RCLWI

- Share the same architecture as LWA but no LWA specific functions
- Measurement and WLAN mobility set
- Steering command
- UE idle mode behavior



Traffic steering from E-UTRAN to WLAN procedure (success case)



Traffic steering from WLAN to E-UTRAN procedure

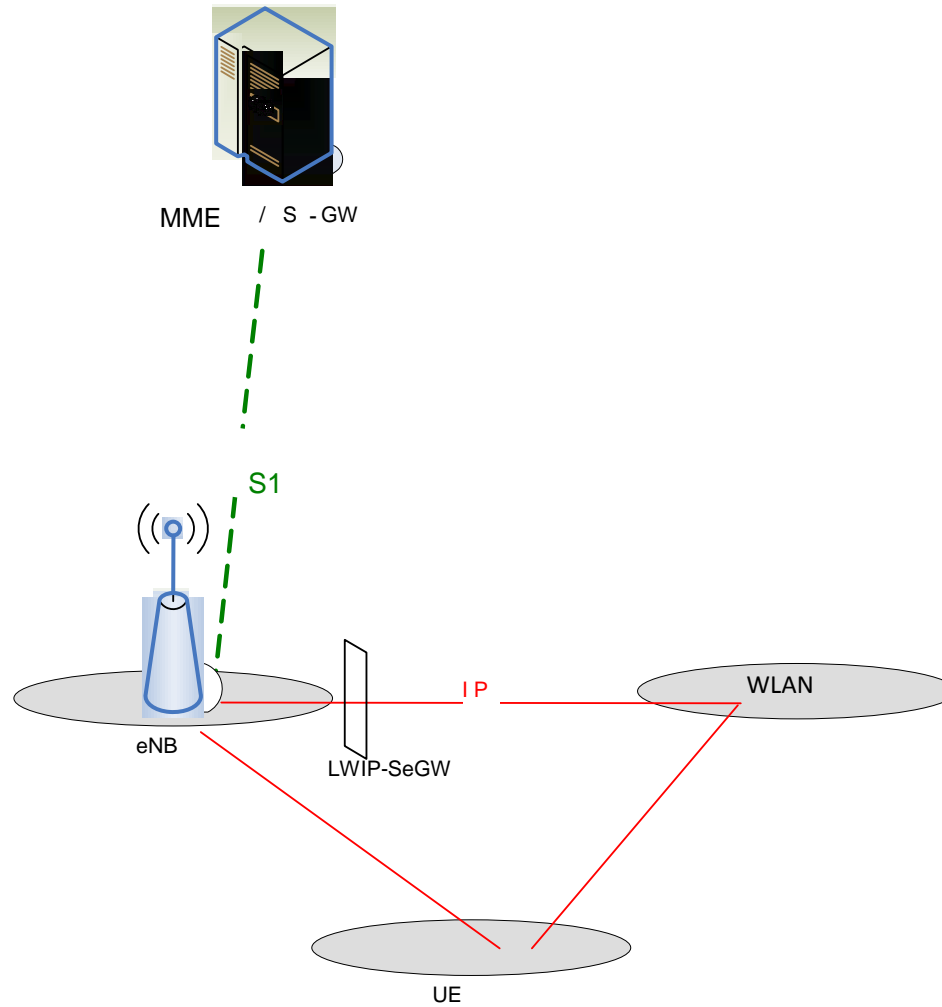
# LTE-WLAN RAN Level Integration supporting legacy WLAN

*started: Sep. 15; target: Mar 15; WID: [RP-151615](#)*

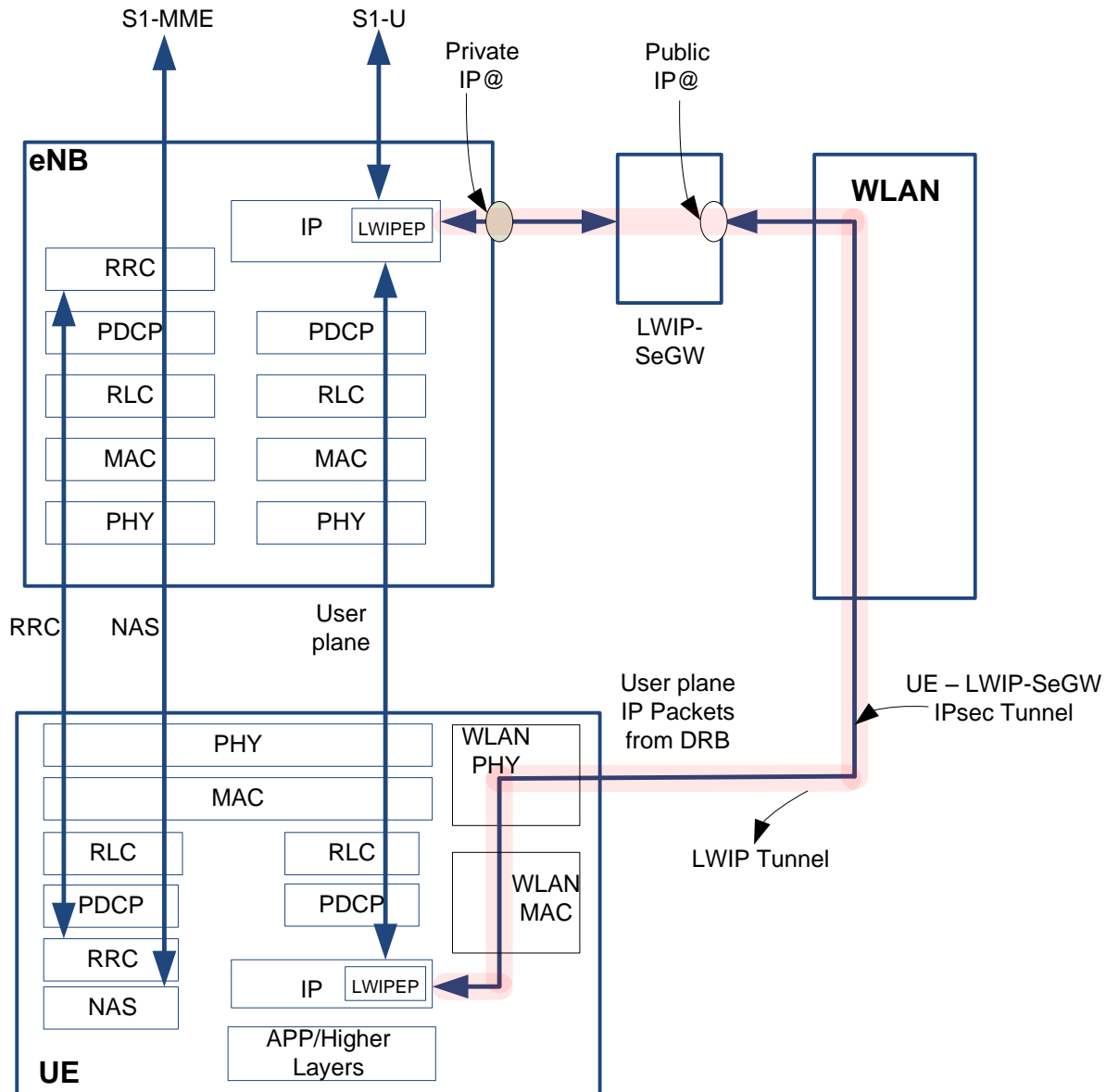
- Objective of SI/WI
  - define a RAN based LTE-WLAN aggregation solution at a bearer level which addresses the legacy WLAN deployment scenarios.
    - without need for modifications to the deployed WLAN node
  - Specify RAN and WLAN protocol architecture of LTE-WLAN RAN level integration at the UE and RAN side based on IPsec tunneling above PDCP protocol layer
  - Specify RRC enhancements for establishing the tunnel between eNB and UE, including required signalling of parameters to the UE
  - Initiation of WLAN aggregation and the IPsec tunnel establishment at the UE is triggered by the eNB via RRC.



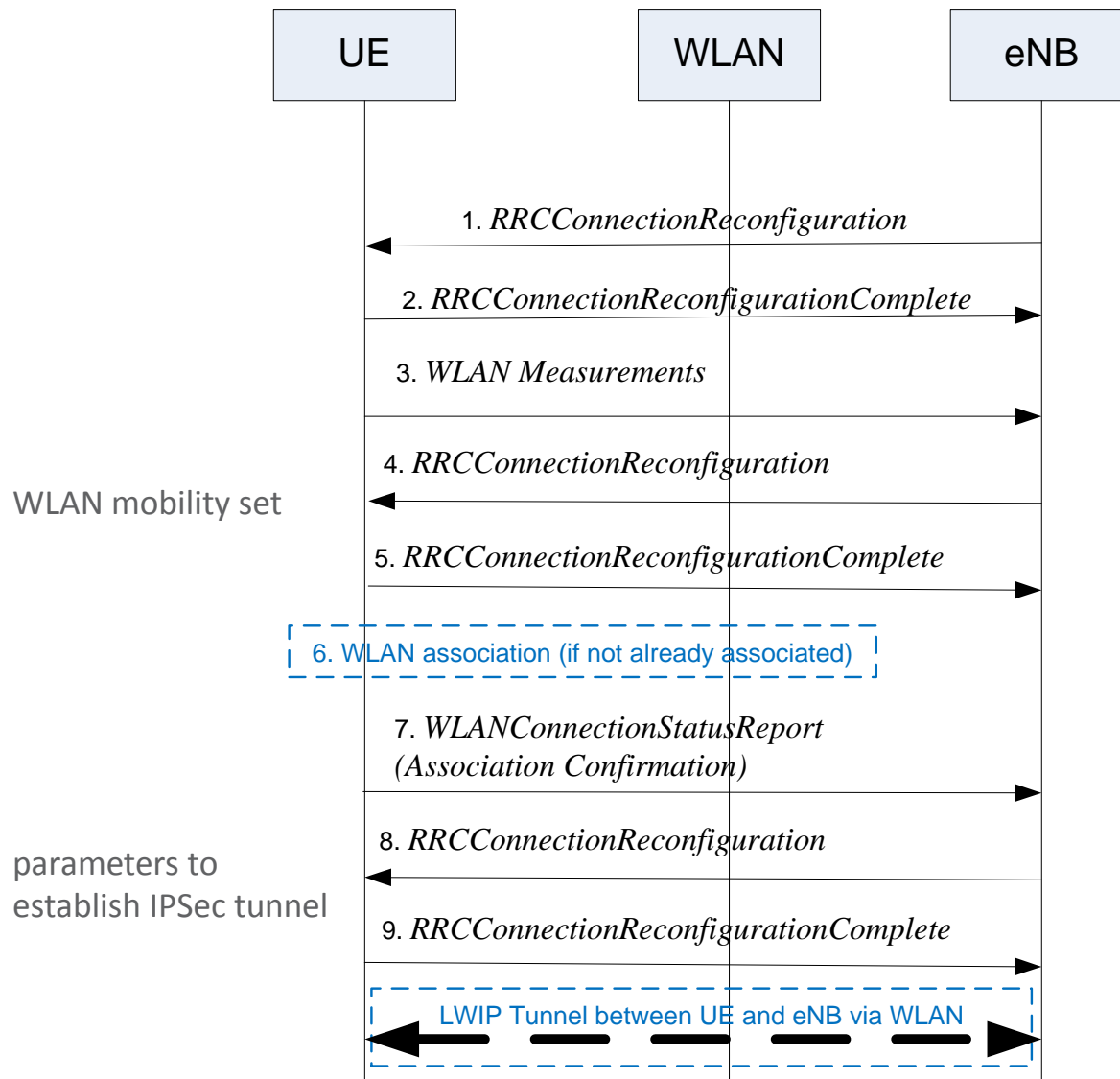
# LWIP Overall Architecture



# LWIP Protocol Architecture



# LWIP Tunnel for data bearer setup procedure



# References and affected technical specifications

36.300  
Overall description;  
Stage 2

CR0809 LTE WLAN Radio Core  
CR0839 LWIP Tunnel Clarifications

36.304  
UE procedures in idle  
mode

RAN-assisted WLAN interworking in idle mode

36.306  
UE Capability

CR0336 Total Layer2 buffer size for LWA capable UE  
CR0337 Introduction LWA and RCLWI UE capabilities

36.323  
PDCP specification

CR0158 LWA PDCP status report

36.331  
RRC; Protocol  
specification

CR2008 Introduction LWA  
CR2051 Introduction RCLWI  
CR2054 LWIP

24.302  
Access to the EPC via  
non-3GPP access  
networks; Stage 3

36.360  
LWAAP

thank you\_\_\_\_\_