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LAA and Wi-Fi Coexistence work – A case study on cooperation

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工業技術研究院
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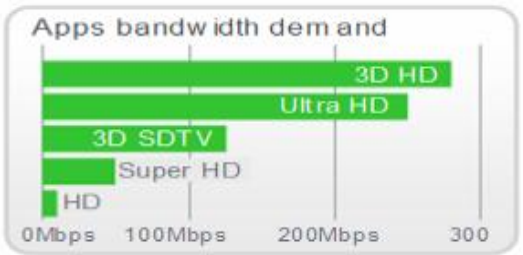
Outline

- Background
- Integration of LTE and WLAN
- Licensed Assisted Access (LAA)
- Summary

Growing Traffic Demand

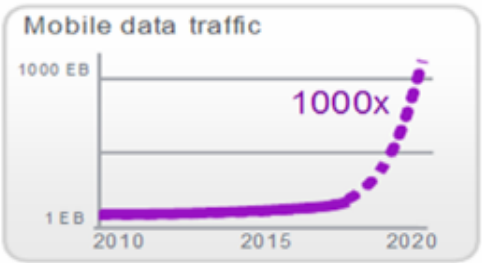
Broadband Applications

Ultra HD (4K、8K…)



Mobile Data Traffic

Increase 1000-fold from 2010 to 2020



Mega Connections

Over50 billion in 2020

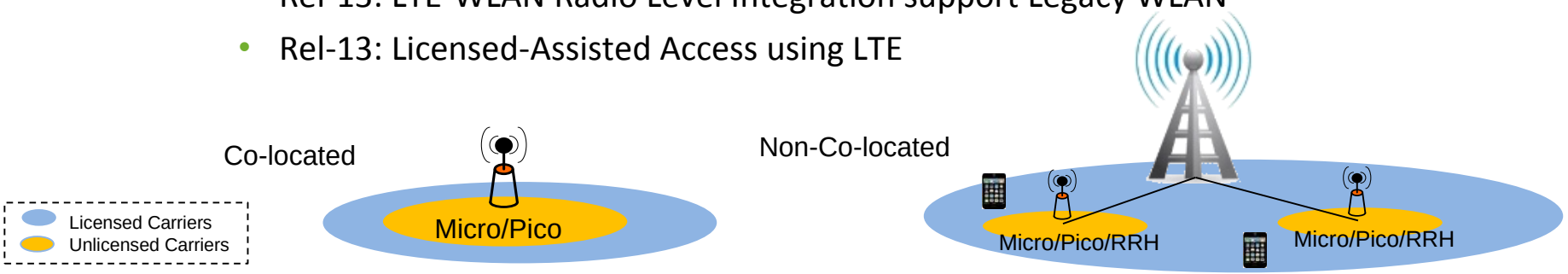
Spectrum Efficiency Requirement

10-fold in 2020

Source：ARIB、Nokia、Qualcomm；ITRI IEK

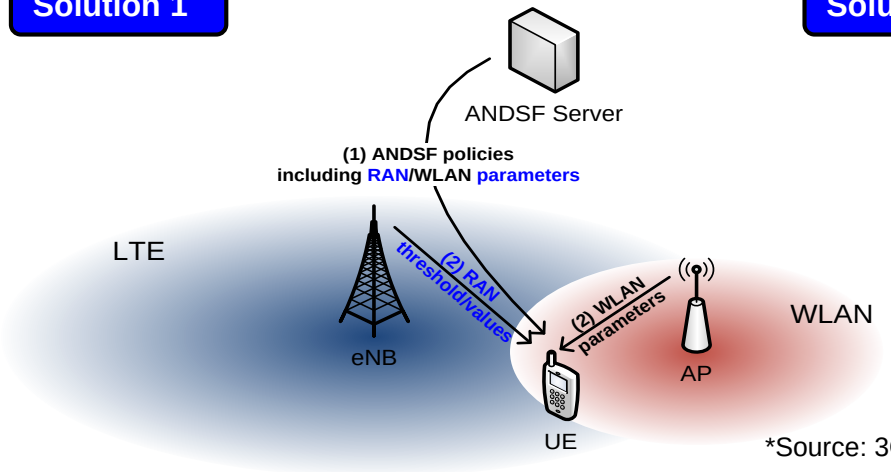
LTE + Unlicensed

- Opportunistic use of unlicensed spectrum is becoming an important complement for operators to meet the growing traffic demand
  - LTE Related SI/WI
    - Rel-12 LTE/WLAN Interworking
    - Rel-13: LTE-WLAN Radio Level Integration
    - Rel-13: LTE-WLAN Radio Level Integration support Legacy WLAN
    - Rel-13: Licensed-Assisted Access using LTE

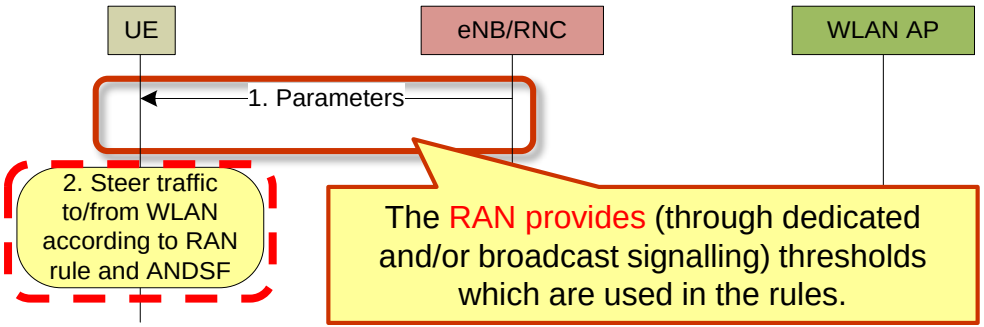


Rel-12 LTE/WLAN Interworking

Solution 1



Solution 2



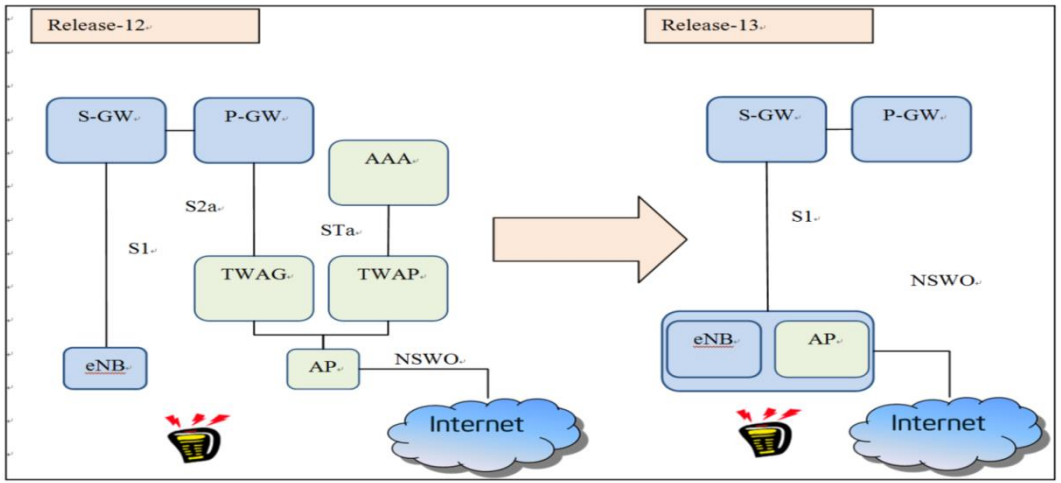
*Source: 3GPP TR 37.834

***RAN provides "RAN assistance information" for ANDSF rules**

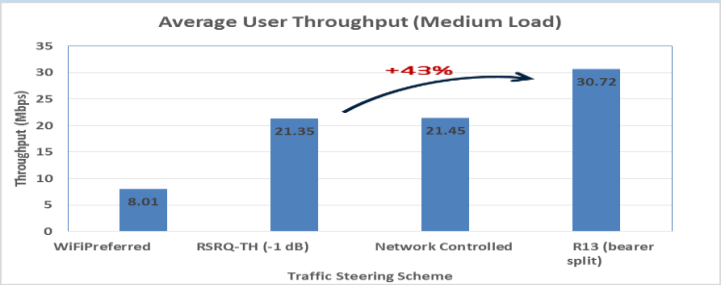
****RAN2 defines "RAN rules" and "RAN thresholds"**

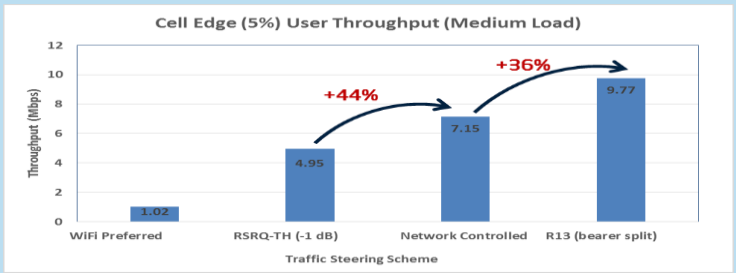
ANDSF: Access Network Discovery and Selection Function

3GPP/WLAN Interworking Evolution



RAN Assisted ⟶ RAN controlled



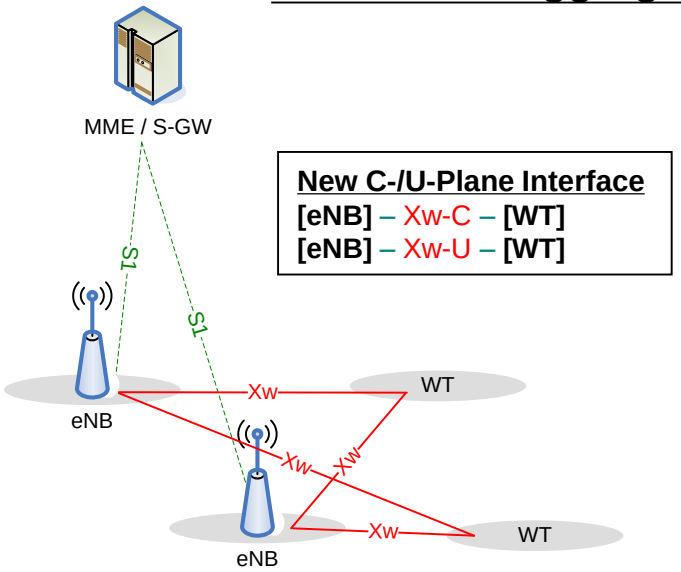


Source: Intel

WLAN Only | Interworking | Interworking Enhancement | Aggregation

Rel-13: LTE-WLAN Radio Level Integration

LTE+WLAN Aggregation

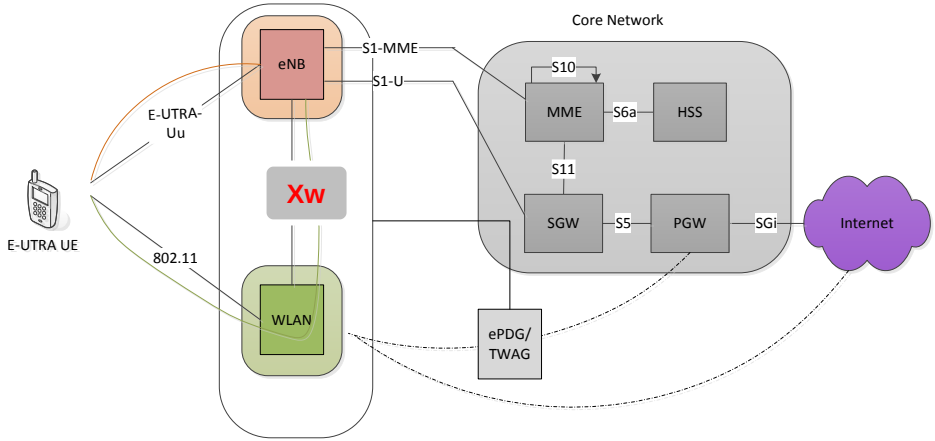


New C-/U-Plane Interface
[eNB] – Xw-C – **[WT]**
[eNB] – Xw-U – **[WT]**

Source: R2-154997 36.300 Running Draft CR

LTE+WLAN Aggregation Architecture

Interworking Enhancement



New C-Plane Interface
[eNB] – Xw-C – **[WT]**

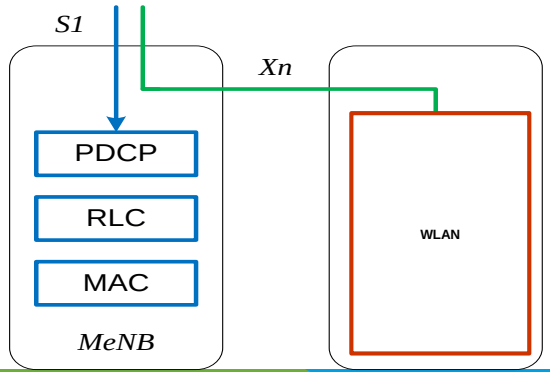
Source Qualcomm R2-151655

Reference Interworking Enhancement Architecture

WT: WLAN Termination

Rel-13: LTE-WLAN Radio Level Integration support Legacy WLAN

- Scope
  - Solution shall support legacy WLAN deployments without any need for modifications to the deployed WLAN nodes.
- Architecture:
  - Based on IPsec tunneling above PDCP protocol layer between eNB and UE over WLAN.



*Detail WI scope in RP-151615

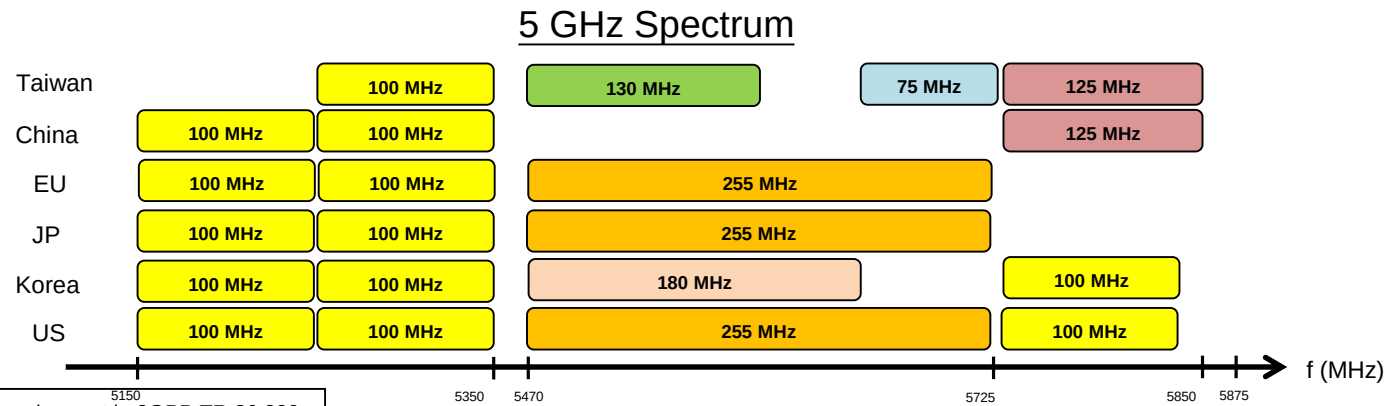
Is it Enough?

- Improvement for WiFi under mobile or roaming scenarios are required.
- Companies see benefits for operators to utilize unlicensed spectrum with a unified network
  - may offer potential operational cost saving, improved spectral efficiency and better user experience (*)

*Refer to RWS 140029

Unlicensed Spectrum

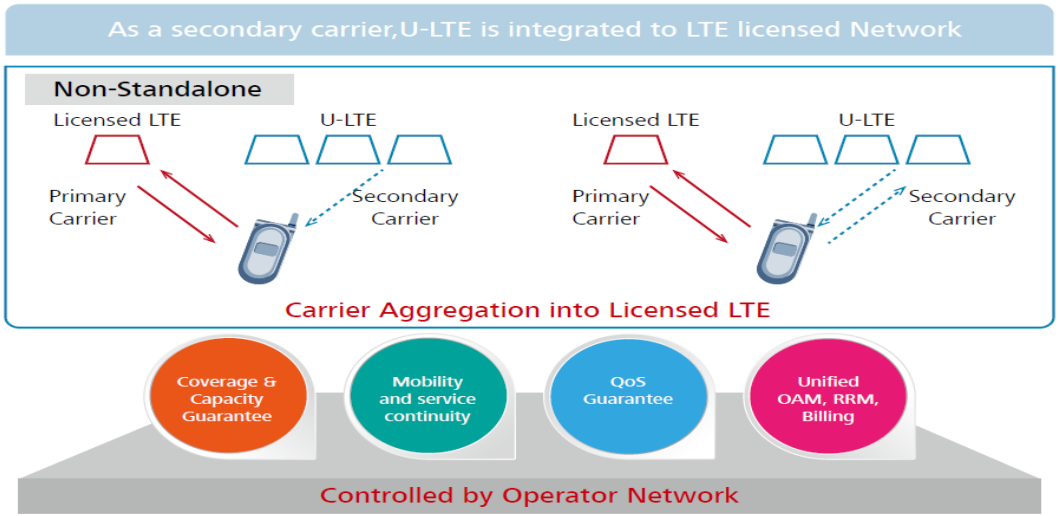
- Band Availability
  - Large amount of unlicensed spectrum available in 5GHz band
- Regulatory
  - Listen-Before-Talk (LBT) and maximum transmission duration etc.



*See detail regulatory requirement in 3GPP TR 36.889

Licensed-Assisted Access using LTE

- Benefit
  - LTE licensed spectrum for performance + LTE unlicensed spectrum for data rate boost
  - Reduce latency and smoother transition
- Facing issue
  - Friendly
  - Fair



Source: Huawei

LAA Design Target

- Single global solution allowing compliance with any regional regulatory requirements
- Effective and fair coexistence with Wi-Fi
- Effective and fair coexistence among LAA networks deployed by different operators

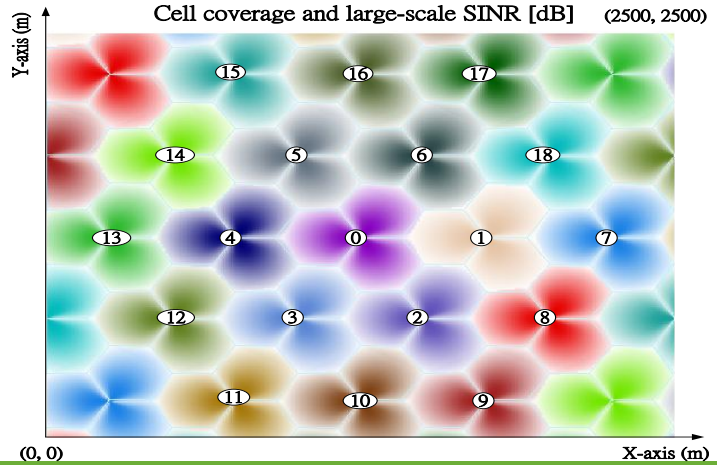
Rel-13 LAA Status

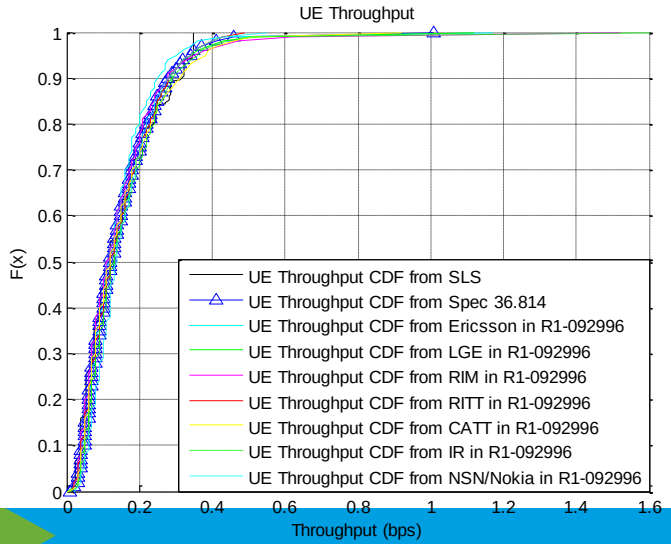
- To be Friendly and Fair coexistence
  - Category 4 LBT mechanism is recommended as the baseline
    - Modified based on ETSI Option B consider LBT and back-off window (*)
    - Status update and joint meeting with IEEE
- Rel-13 focus on unlicensed band as supplemental DL
  - Performance study: Coexistence evaluation results for LAA with only DL transmissions
    - DL-only LAA coexisting with DL+UL Wi-Fi
    - Performance metrics include UPT, delay, 5th, 50th and 95th percentile and mean values, and low, medium and high loads etc.

(*)See detail in 3GPP TR 36.889 – 7.2.1.6

Wireless Simulator Evolution (WiSE)

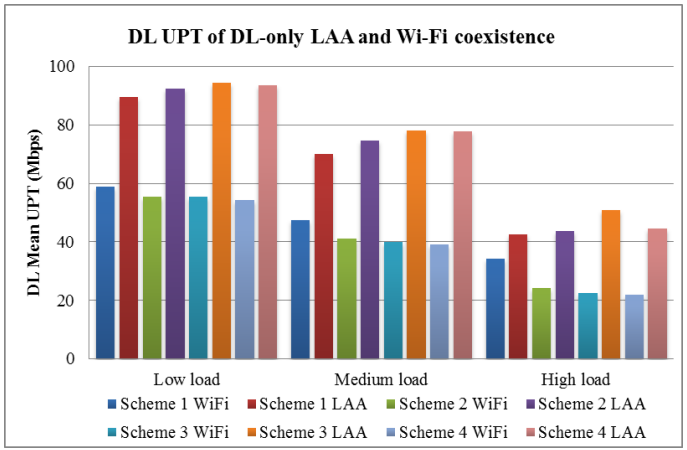
- ITRI developed 4G/5G System Level Simulator
  - Support standard 3GPP eNB/Cell deployments with 1000+ UEs under different mobility scenarios (such as Rural / Urban / Indoor etc.)
  - Calibrated system level simulation results

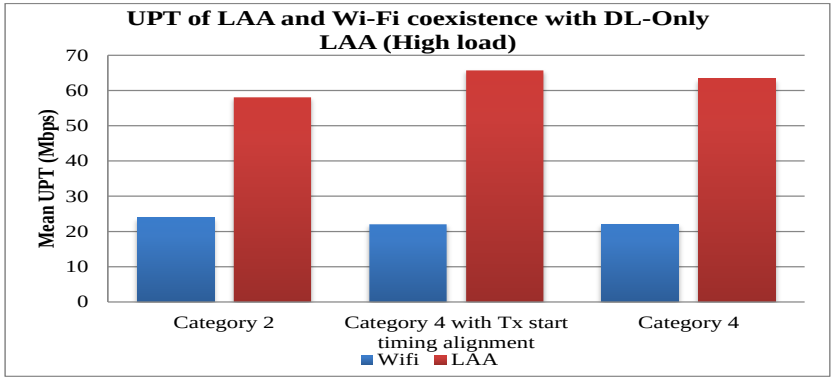




Observations from LAA Evaluation Results

- Evaluation results of an LAA network operating a category 4 DL LBT scheme showed that it can operate without impacting Wi-Fi more than an equivalent Wi-Fi network (*)
- LAA can coexist with WiFi and outperform it in terms of spectral efficiency





Source: ITRI (R1-154369, R1-155555)

***See detail in 3GPP TR 36.889 – 8.3.1**

Summary

- LTE + Unlicensed can increase spectral efficiency
  - Improve Coverage
  - Reduce Latency
  - Enhance Peak Data Rate
- LAA and WiFi Coexistence
  - Toward being friendly and fair in unlicensed band
  - Evaluation results showed that LAA can operate without impacting Wi-Fi more than an equivalent Wi-Fi network.

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Thank You!!