
Consideration on LTE-WLAN interworking architecture



Introduction

- As part of the discussions on the proposed SID on **LTE-WiFi aggregation & interworking**, the notion is being put forward to also consider the Dual Connectivity 1A architecture
 - It is argued that a “**Dual Connectivity 1A architecture with WiFi**” would address certain use cases of interest
- We believe that there is overlap between “Dual Connectivity 1A architecture with WiFi” and some work that has been done by SA2

Status of WLAN offloading in SA2

Rel.12

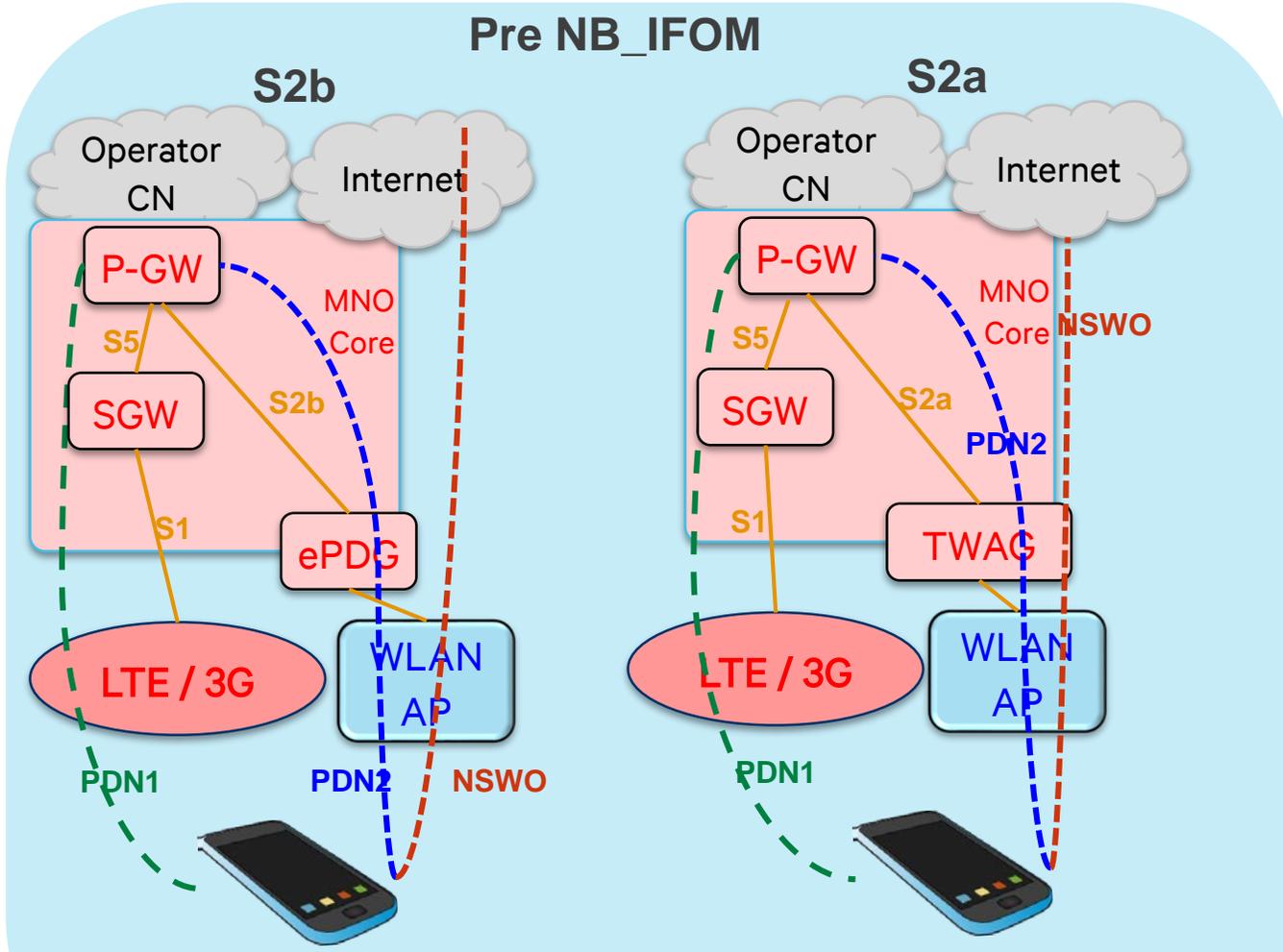
- SA2 has defined several solutions for WLAN offloading based on S2 interfaces (S2a, S2b) and S2c (DSMIPv6)
 - In all solutions mobility is triggered by the UE (based e.g. on ANDSF policies, RAN rules, etc.)
 - In all these solutions P-GW is the anchor for traffic
- These enable UE to access EPC through WLAN and move traffic between 3GPP and WLAN seamlessly
- The operator can control the selection and steering of traffic, e.g. through ANDSF or Rel-12 RAN assistance
 - Some radio parameters can be considered in UE decisions
- Types of mobility
 - APN level mobility supported in all cases
 - IP level mobility (IFOM) supported for S2a and S2b only between 3GPP access and NSW0 (Non-seamless WLAN offloading), which implies change of IP address
 - IFOM fully supported in S2c

Rel.13

- IFOM is being further enhanced for network based mobility (TR 23.861)
- UE communicates with P-GW for IP flow routing decisions

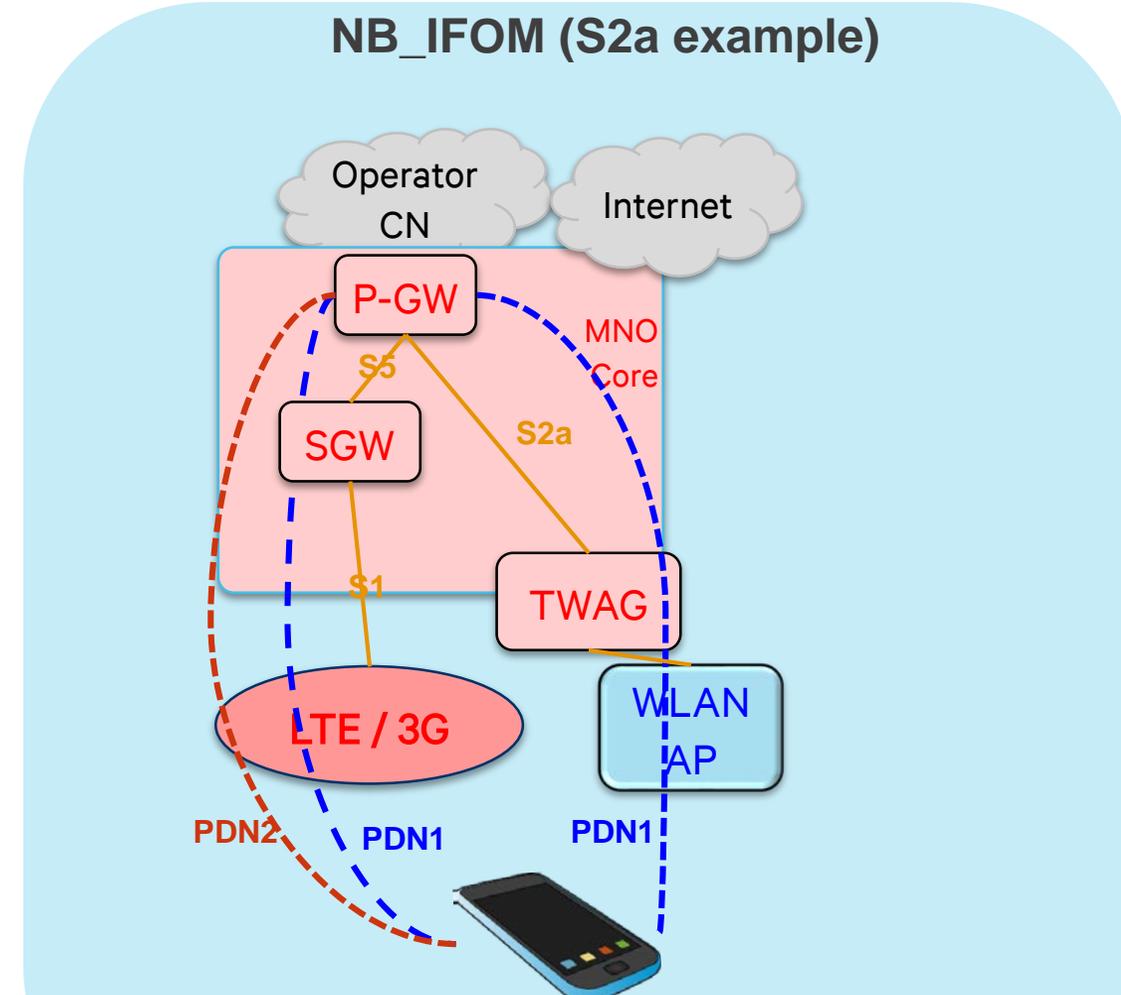
Overview of SA2 Solutions

Pre NB_IFOM



- UE sends separate PDN connections over different accesses
- UE triggers the mobility in all cases

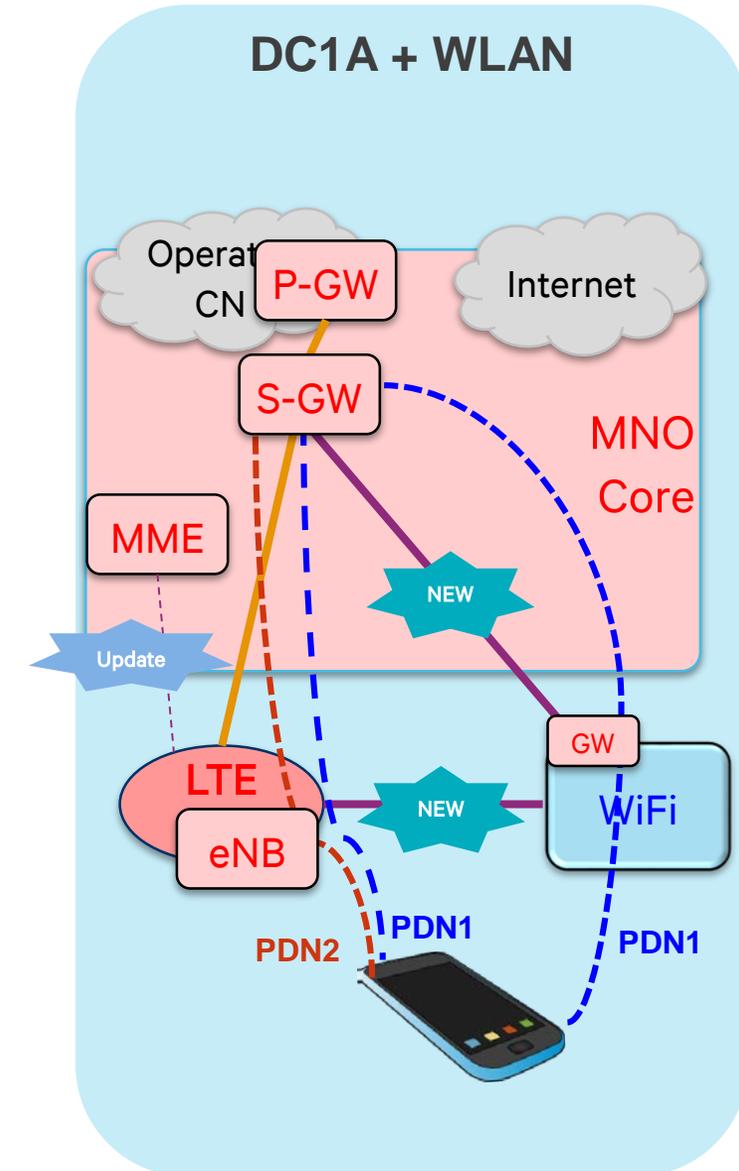
NB_IFOM (S2a example)



- For a PDN, the UE can send some flows over 3GPP access and others over WLAN
- UE or PGW can both trigger the mobility of IP flows

DC 1A solution applied to WLAN offloading

- Dual Connectivity 1A option: a bearer can be served by either MeNB or SeNB:
 - This was developed to address deployments where X2 between MeNB and SeNB is not good enough to forward data (as in split bearer)
- It is theoretically possible to extend this to an eNB and AP:
 - It requires a new interface from S-GW to WLAN
 - It requires a new interface from eNB to WLAN for control
 - Extend S1-C signaling to allow bearer switching between eNB and WLAN
 - Unless the S-GW to WLAN interface can be made exactly same as S1-U (which should be studied by SA2)
- This **requires changes to CN nodes** (MME and S-GW) and standardization of a new CN interface (from S-GW to WLAN)
 - **WLAN nodes will have to terminate two new interfaces**
 - It requires involvement of SA2 due to architecture changes
 - It requires involvement of SA3 to investigate user plane security:
 - Authentication and user plane key derivation is needed



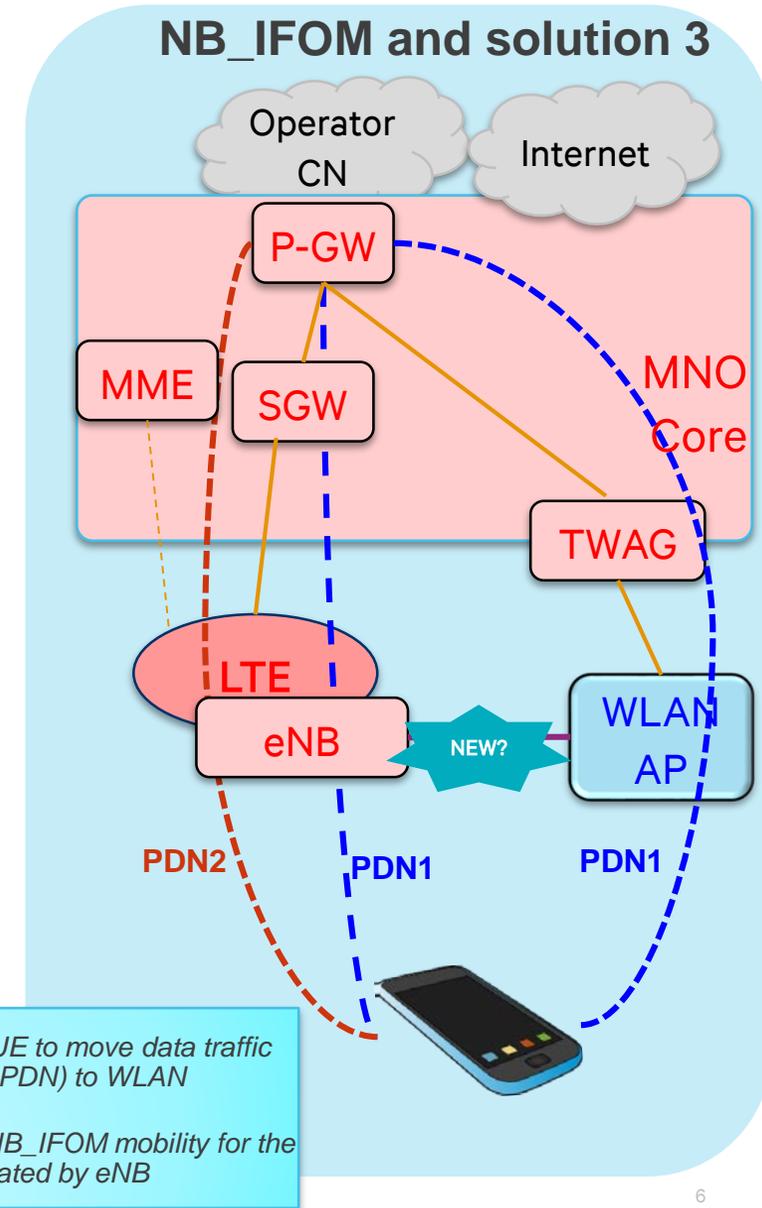
NB-IFOM + Solution 3

The functionality offered by 1A could be achieved (if desired) by “solution-3” and (NB)-IFOM **with small modifications to current Rel. 13 NB_IFOM TR:**

- eNB triggers UE to move data traffic between accesses
- In turn, UE triggers NB_IFOM mobility **using mostly mechanisms already being defined**
- Solution-3 can complement current deployments with changes to eNB & UE only
 - (NB)-IFOM can enable IP flow steering; e.g. combining eNB decisions with user preferences
- The additional latency of switching compared to DC 1A is the message exchange between eNB and UE (15-20ms). Since the offloading decisions must be made on much larger time scales, this additional latency will not have any impact on switching performance

WLAN offloading deployments using S2 interfaces have been commercially deployed and used even for real-time seamless services

- The problems in mobility (as claimed) should be demonstrated, and whether the cause is CN based signaling load should be investigated



1. eNB triggers UE to move data traffic (for a NB_IFOM PDN) to WLAN

2. UE triggers NB_IFOM mobility for the data flows indicated by eNB

Conclusion

- “Dual Connectivity 1A with WiFi” addresses a case that could also be addressed with “NB-IFOM + solution 3”
- If there is interest to address such case, the work belongs to SA2:
 - E.g. development of a new interface between non-3GPP RAT & EPC

Thank you

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