

Motivation for WI Support for Virtualized RAN in NR



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NFV support & Shared central UP for DC



Network function virtualisation (NFV) is one of the key elements and key requirements for the 5G System

- 38.913 states that RAN architecture shall allow deployments using Network Function Virtualization
- 38.801 states that NR shall allow Centralized Unit (CU) deployment with Network Function virtualization (NFV)
- 38.401 defines a Network Function as "a logical node within a network infrastructure that has well-defined external interfaces and well-defined functional behavior."

NFV allows flexibility in time and location:

- in other words, it allows to assign network functions (i.e. logical nodes) to hardware resources
 - at most appropriate places,
 - of the currently desirable amount,
 - when needed.

NFV support & Shared central UP for DC



Allows flexibility in using hardware resources, and results in capacity/pooling gains, compared to static allocation of hardware resources to logical nodes; namely, the same hardware resource can be assigned to different logical nodes at different times, instead of a single logical node.

Of course, logically, a certain single process, e.g. an instance of an NR PDCP protocol entity, can only belong to one, and only one logical RAN node, but, as soon that single instance of an NR PDCP protocol entity is released, it can be allocated anew to another logical RAN node.

Such a pool of RAN UP protocol entities may be realised in a single physical hardware entity, a central UP entity, and it follows key requirements for 5GS for NFV.

Shared central UP entity



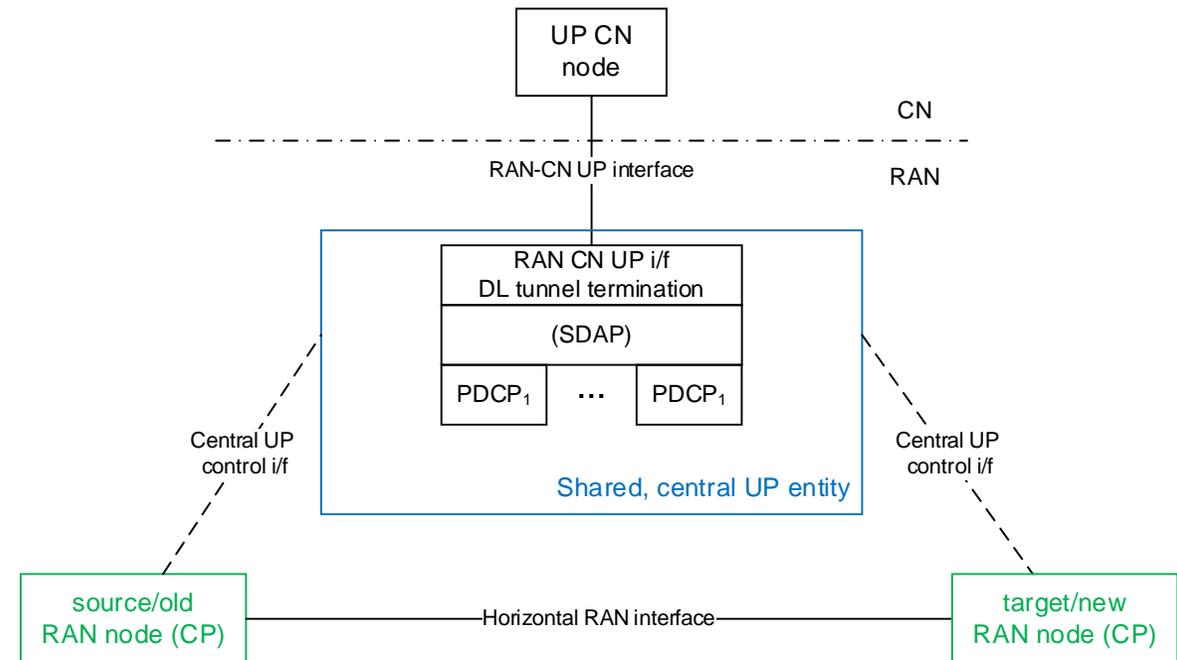
For NG-RAN (including all dual- and multi-connectivity scenarios):

- such a central UP entity would provide UP interface termination points (i.e. NG-U, Xn-U and F1-U)
- provide resources for instantiating protocol entities (e.g. GTP-U, SDAP, PDCP)
- and would provide access to these resources via a control interface towards a logical CP node.

The control interface would be the E1 interface (CP only) in case of gNB-CU.

- If the gNB-CU is implemented as a single logical node (i.e. no CP-UP split is deployed), then such interface would be internal to the gNB-CU.

The figure shows a possible CU-UP function virtualization for 5GS and NG-RAN consisting of gNBs



Shared central UP entity



The shared, central UP entity.

- Offers central higher layer UP resources to one or several RAN nodes
 - In case of E-UTRAN, a UP resource configuration consists per E-RAB of an DL S1-U tunnel termination and an PDCP entity.
 - In case of NG-RAN, a UP resource configuration consists of one per PDU Session DL NG-U tunnel termination, an SDAP entity (max. 2 SDAP entities in case of DC in Rel-15) and one PDCP entity per DRB
- With the UP resources provided to logical RAN nodes, the shared, central UP entity is logically part of that logical RAN node

Performance benefit



Overall network performance will benefit from such approach:

- at **Handover**, CN internal signalling can be skipped
 - if all bearers are kept, no SMF/AMF update signalling, only the NG-C/S1-MME termination changes to the target node
- at **Resume** in a new RAN node, like for HO, CN internal signalling can be skipped
- for **Dual Connectivity**, if the (SDAP/) PDCP entity for a DRB is moved in between Master and Secondary node,
 - for 5GS, only a single NG-U tunnel is necessary, as the split towards 2 SDAP entities can be regarded as a UP node internal matter.
 - signalling towards the CN is not necessary at all (this implies that also CN internal signalling can be skipped)
 - any kind of QoS flow or DRB offload in between involved RAN nodes would be completely unnoticed, i.e. neither CP or UP related changed on the NG interface configuration necessary.
- for all the 3 scenarios, data forwarding is a UP node internal matter.

