

15th – 16th June 2023

RAN architectural enhancements

Agenda Item:	5
Source:	Intel Corporation
Document for:	Discussion



Motivation/limitations of current architecture

Current RAN architecture prevents fast, secure and reliable control signalling to the UE

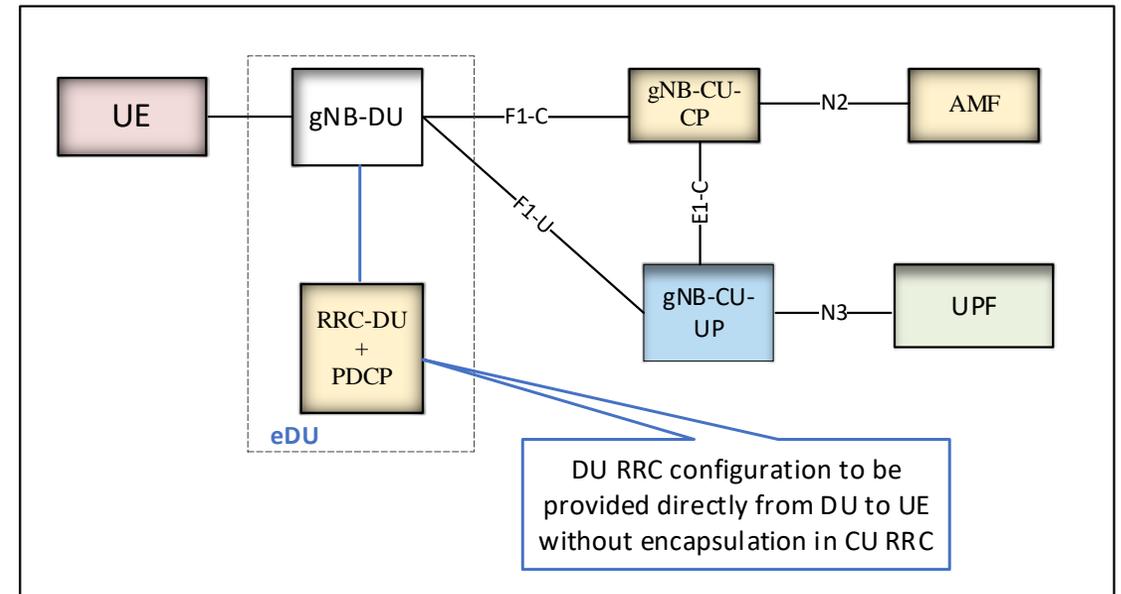
- Current architecture creates unnecessary signalling delay and dependency between DU and CU for lower layer configuration
 - DU generated RRC signalling to control L1 and L2 are sent to CU for security and encapsulation in RRC Reconfiguration message
 - Larger RRC processing delay of RRC Reconfiguration message
- Current architecture creates additional security risk already being raised by SA3 and academia
 - Increasing use of MAC CEs to avoid current RRC delay creates more security risk
- Configuration information from DU delivered to UE by MAC-CEs less reliable than that delivered by RRC (HARQ only, no RLC)

For a specific UE, all user plane has to be in one physical CU-UP location

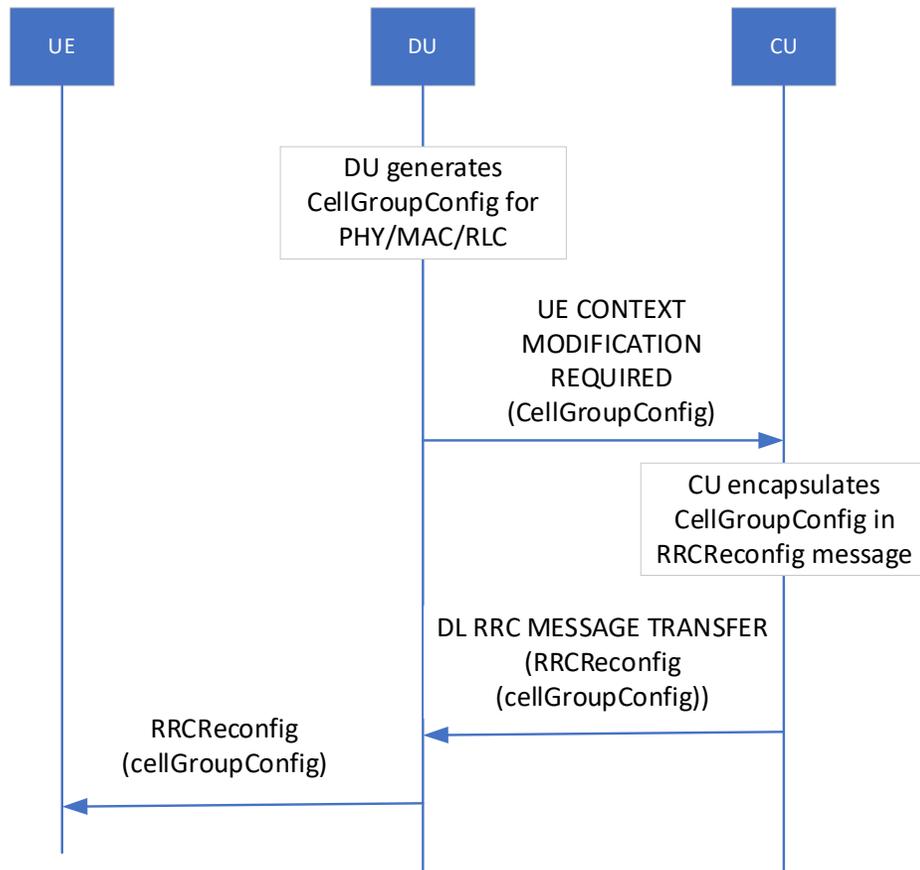
- Prevents termination of secure data to different end points
 - For slicing, local breakout, deployment flexibility etc.

Potential enhancements

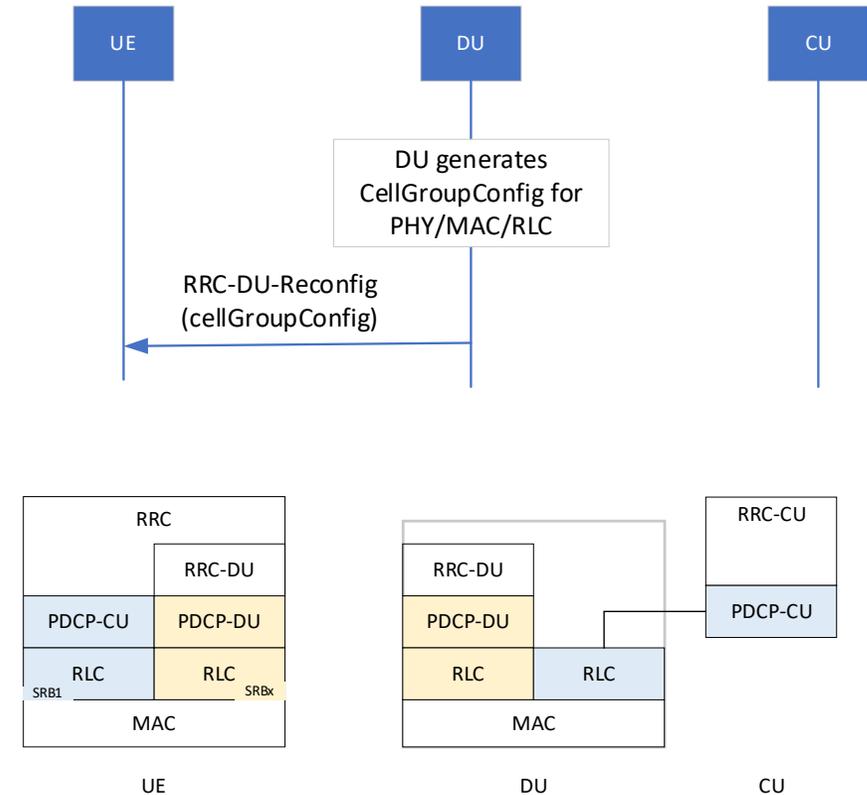
- Key architectural changes
 - Support direct transfer of RRC messages generated at DU to the UE
 - Allow DU to generate RRC messages for DU configuration (e.g. CellGroupConfig) and send directly to UE without transferring to CU
 - Support PDCP termination at DU for security.
 - Reduced RRC processing delay
 - Introduce “simpler” RRC messages (similar configuration contents as MAC CEs) generated at DU
- Possible architectural approach
 - New RRC message to encapsulate RRC-DU and MAC-CE like control information
 - Define new SRBx for RRC-DU directly from DU to UE
 - PDCP for SRBx at DU with DU specific security keys



Example Message flow and protocol stack



Current message flow for DU generated CellGroupConfig



Example message flow and protocol stack with DU security for DU generated CellGroupConfig

Architectural flexibility

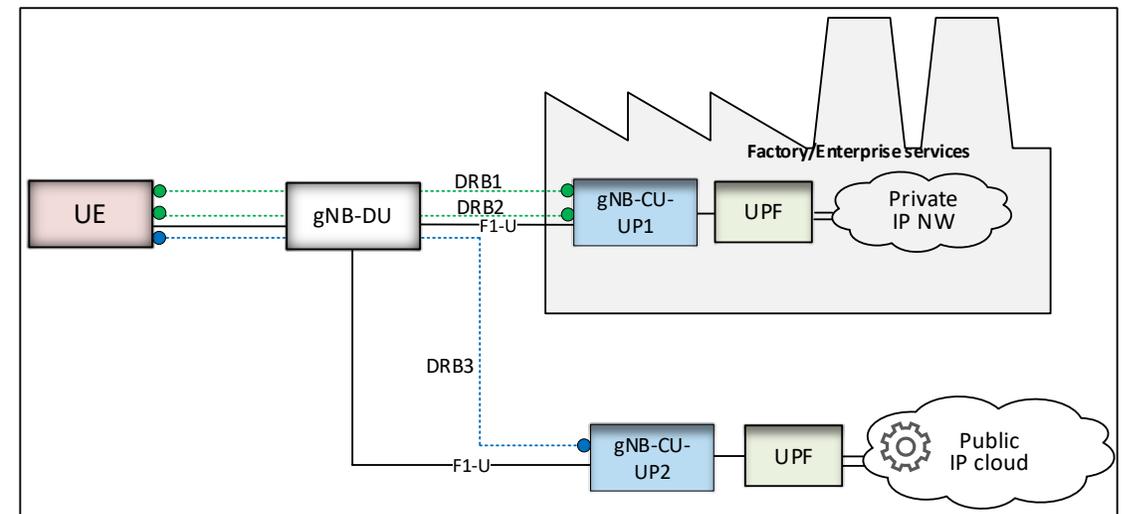
- Support both new and old architectures
 - RRC
 - Continue to allow CellGroupConfig to be in RRC Reconfiguration message as today
 - MAC CEs handling
 - Continue defining MAC CEs as today
 - Also allow encapsulation within RRC for security or define in RRC-DU
 - Can be applied for specific MAC CEs that are considered security risk
 - E.g., LTM measurements, cell switch command,
 - Processing delay
 - Define lower RRC processing delay for simpler RRC-DU messages

Example specification details

- No fundamental changes to the current architecture
 - CU RRC, security remains unchanged
 - Overall DU functionality also remains changed (apart from addition of PDCP at DU)
 - Minimal impact on CU and F1
 - Continue to use CellGroupConfig in RRC Reconfiguration message as today if it impacts CU configuration
- No new security vulnerability
 - All of the CU originated messages still secured at the CU
 - Only configurations that are generated at the DU are secured by DU
 - No new information exposed at the DU

UP: Support of connectivity to multiple CU-UPs

- User plane
 - Allow a UE's UP terminations in different final physical end points (e.g. for enterprise services and public cloud)
 - Introduce additional security termination points
 - Support of multiple distributed CU-UP termination points with separate security key handling



Summary and proposal

- Current RAN architecture prevents fast, secure and reliable signalling of lower layer configurations
 - Longer delay in configuration by DU generated signalling sent via CU
 - Security risk from using MAC CEs to avoid RRC delay
 - Less reliable transmission (no RLC) for MAC CEs
- Single security termination point for User plane termination point restricts deployment flexibility
- Proposals:
 - Introduce direct RRC signalling from DU to UE with PDCP in DU
 - Support of multiple distributed CU-UP termination points with separate security key handling

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