3GPP SA3 6G Study Conference Call

Qualcomm Incorporated

Agenda

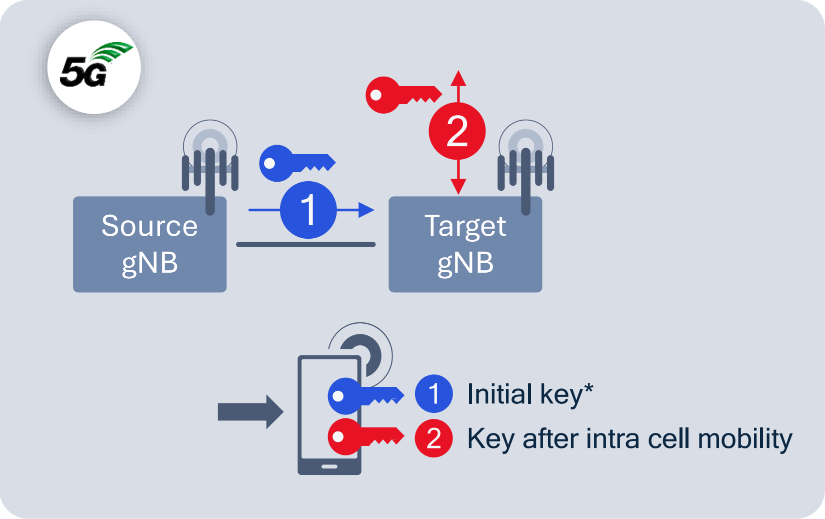
- Security for RAN Mobility
- Enhanced AS key handling
- Robust security setup
- Isolation of UE security contexts
- Security evaluation and dynamic policy

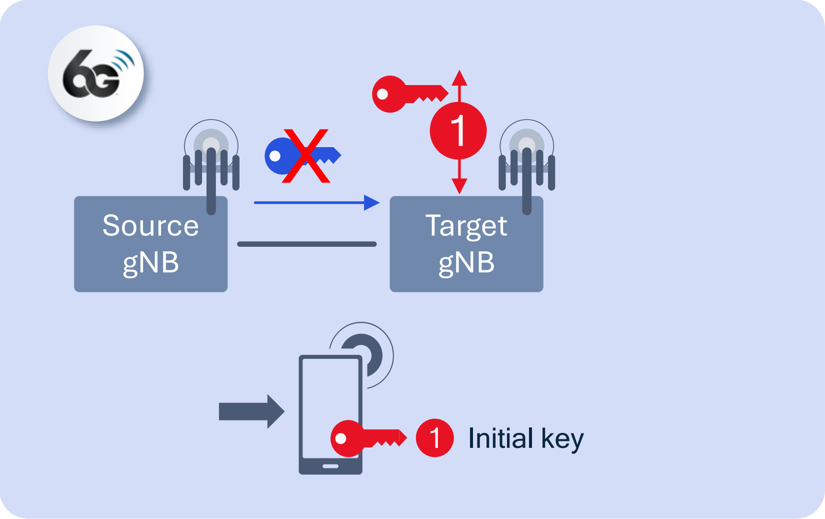
Security for RAN Mobility

Key hierarchy for enhanced security in mobility

- 5G Key change during mobility
  - RRC signaling for key change is always required
  - Source gNB knows the key at the target gNB for Xn-based mobility
  - Intra-cell HO is required to support forward security
- Limitations
  - Key separation between gNBs is not immediate for Xn-based mobility
  - K_{gNB} cannot be prepared at multiple gNBs to support flexible mobility, e.g., subsequent LTM
  - Deployment is inflexible due to potential impacts of RAN procedures on AMF or vice versa
- Potential 6G enhancements
  - Support *immediate* forward/backward security by design with vertical key derivation for 6gNB change (or 6G-CU change)
  - Support multiple *concurrent* key preparation at different RAN nodes

→ Horizontal key derivation
→ Vertical key derivation



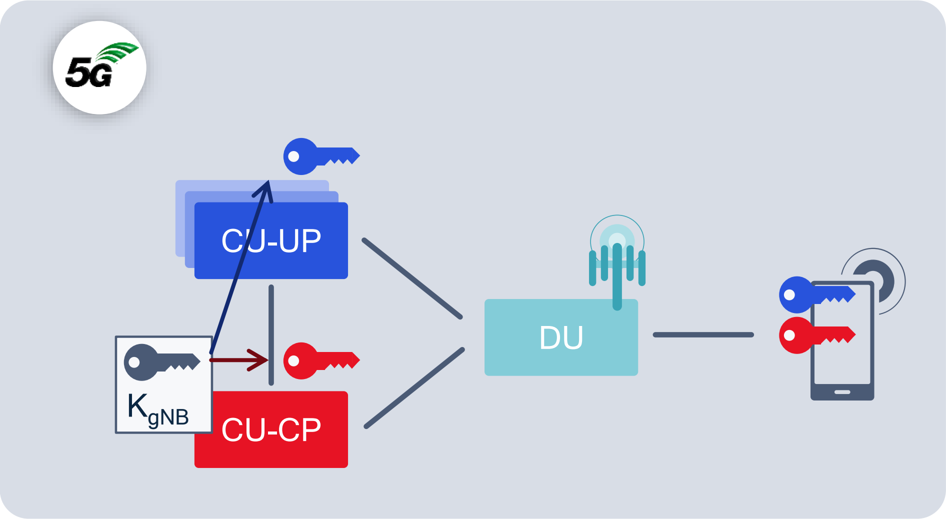


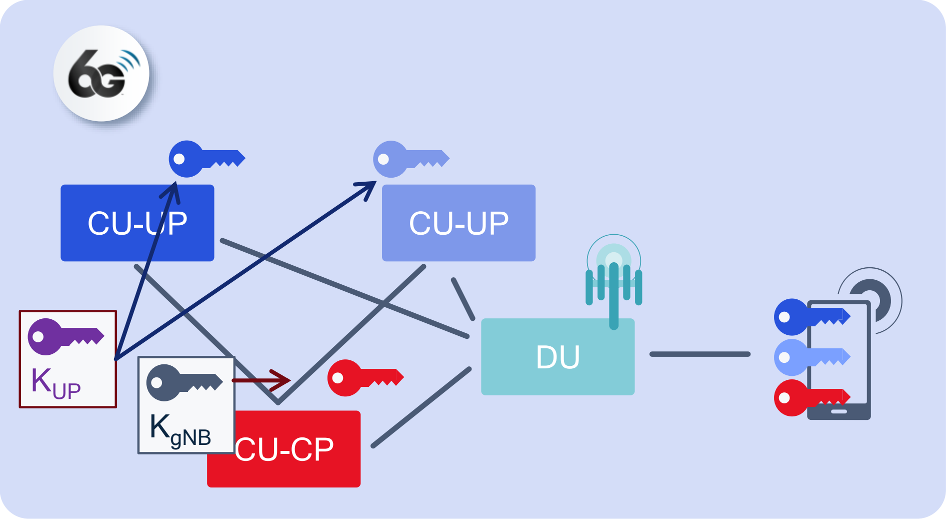
*Initial key refers to the key used at the target gNB after inter-gNB mobility

Enhanced AS key handling

User-plane security anchor to support of different UP termination points per application/service needs

- 5G User plane security
  - A UE may be connected to multiple CU-UPs (1 per PDU session)
  - KgNB change also requires UP key change
- Limitations
  - No key separation when multiple CU-UPs are configured for a UE
  - No key separation for different PDU sessions/slices
  - Frequent UP key changes required for highly mobile UEs
  - UP security processing overhead while CU-UP may stay same in gNB change, e.g., CU-UP shared by multiple gNB-CUs
- Potential User plane security enhancements
  - Support of different UP termination points per application/service needs, e.g., location(s) of CU-UP is determined by network using UE mobility pattern, UE capability, service security requirements
  - Service specific configuration which enables security isolation of services as desired
  - UP key separation from KgNB

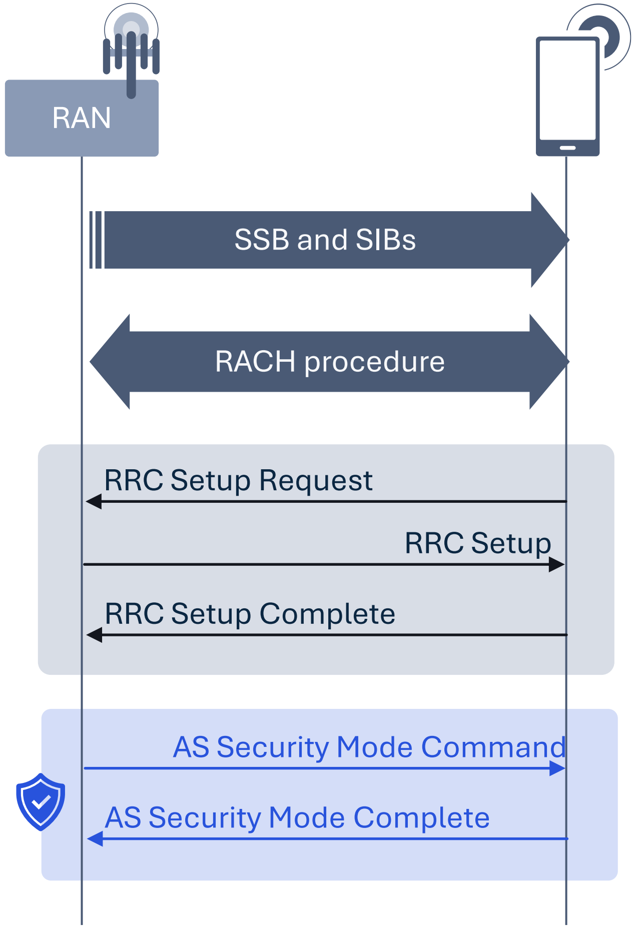




Robust security setup

Ensure integrity of the messages exchanged before the Security Mode Command activates AS security

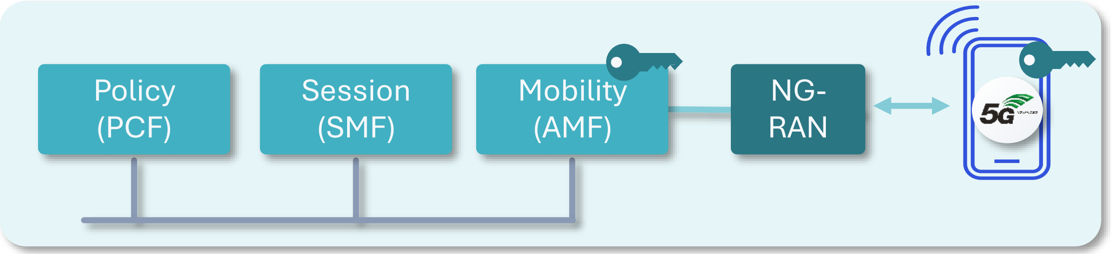
- 5G AS security setup
  - Messages exchanged prior to the Security Mode Command are sent unprotected, e.g., RACH, RRC setup messages,
- Potential threats
  - Manipulation of messages before the SMC can lead to UE being misconfigured
- Potential 6G AS SMC enhancements
  - ***Verification*** of messages exchanged prior to AS Security Mode Command procedure
    - This is similar to initial NAS protection
  - Upon detecting an error/mismatch, 6G-NB either provisions correct parameters or releases connection

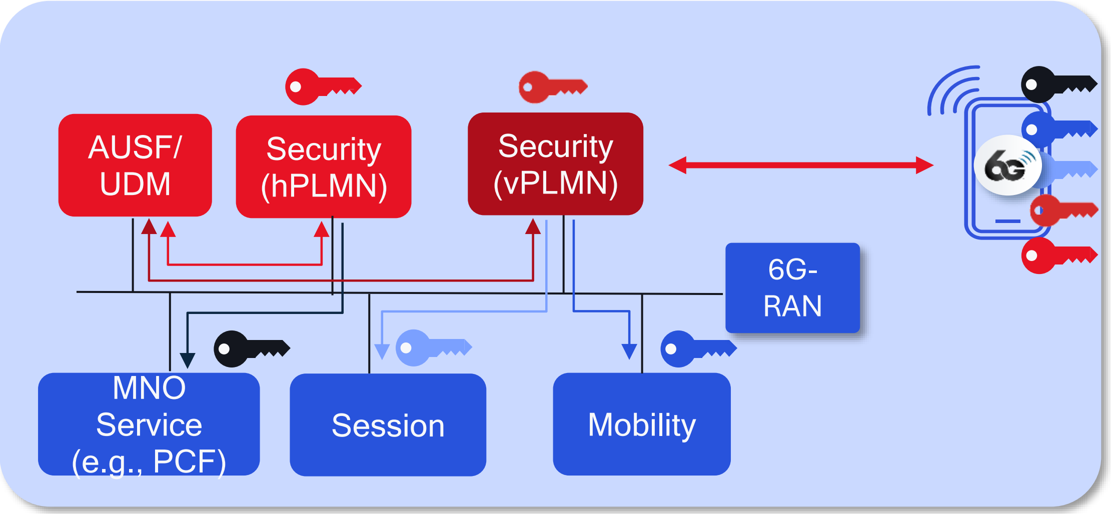


Isolation of UE security contexts

Independent security contexts at each network functions/services

- 5G NAS security
  - NAS messages are securely exchanged between UE and AMF
  - Single security termination point at AMF
  - Initial AMF is the trust anchor for 5G security until the next authentication
- Limitations
  - No generic secure communication channel between HPLMN and UE (e.g., HPLMN relies on VPLMN to deliver UE policies)
  - No forward security in AMF relocation, i.e., source AMF knows the NAS key at the target AMF and henceforth
    - 5G SEAF is collocated with AMF and only used for initial AMF key derivation
  - Secure access to **new** control plane services may require changes to the existing network function (e.g., AMF)
- Potential 6G NAS security enhancements
  - Independent 6G SEcurity Anchor Function (SEAF)
  - Separate security anchors at HPLMN and VPLMN
  - Independent and secure access to control plane services, e.g., for easier service deployment

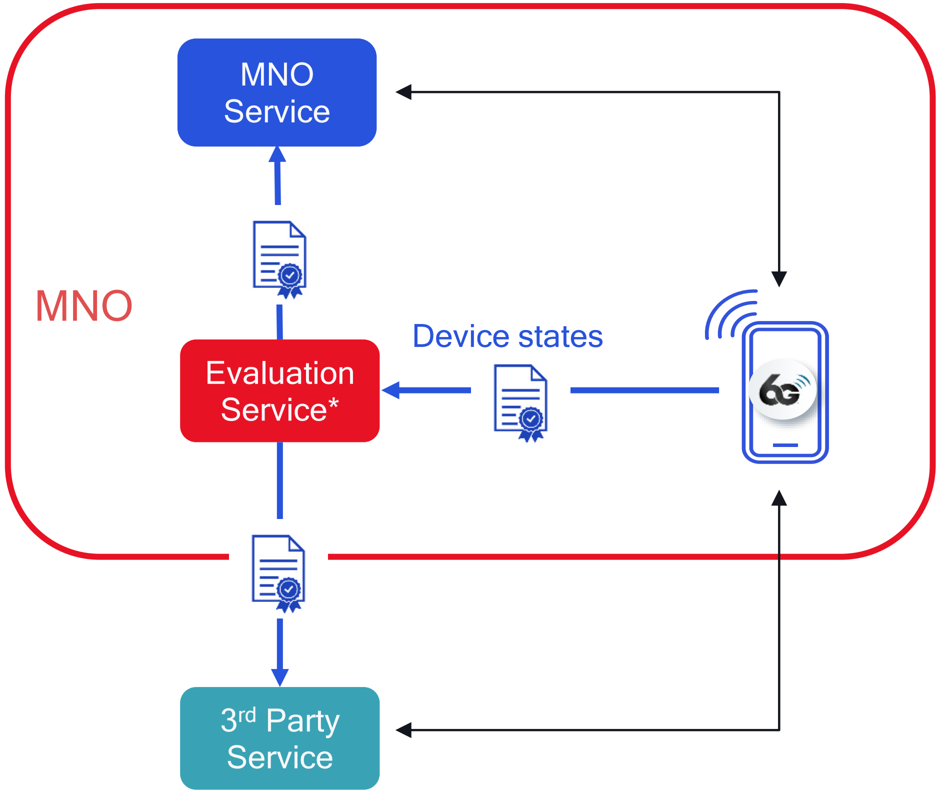




Security evaluation and dynamic policy

Help evaluate and strengthen overall security of the cellular system

- 5G security
  - Authentication and authorization only based on the subscription credentials
  - Secure connection and/or service access only based on primary authentication and subscription (authorization) information
- Potential threats
  - Compromised or unpatched devices/NFs (including UE) may waste operator's network resource
- Potential 6G security enhancements
  - Support collection of 6G device (security) state information periodically or on-demand
  - Define/collect 6G device (security) appraisal policy for service access
    - Appraisal policy defined for each service, e.g., HW model, HW version, SW version, …
  - Make 6G device (security) evaluation results available to NF service producer/consumer to help enforce respective security policy
  - Additional use cases include device authentication, data provenance,…



*Evaluation Service may obtain device state information from 3rd parties

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