LTE Security

Encryption and Integrity Protection in LTE

LTE Security: Key Concepts

Authentication

- The LTE Network verifies the UE's identity by challenging the UT use the keys and report a result.
- The network checks the result against the expected result

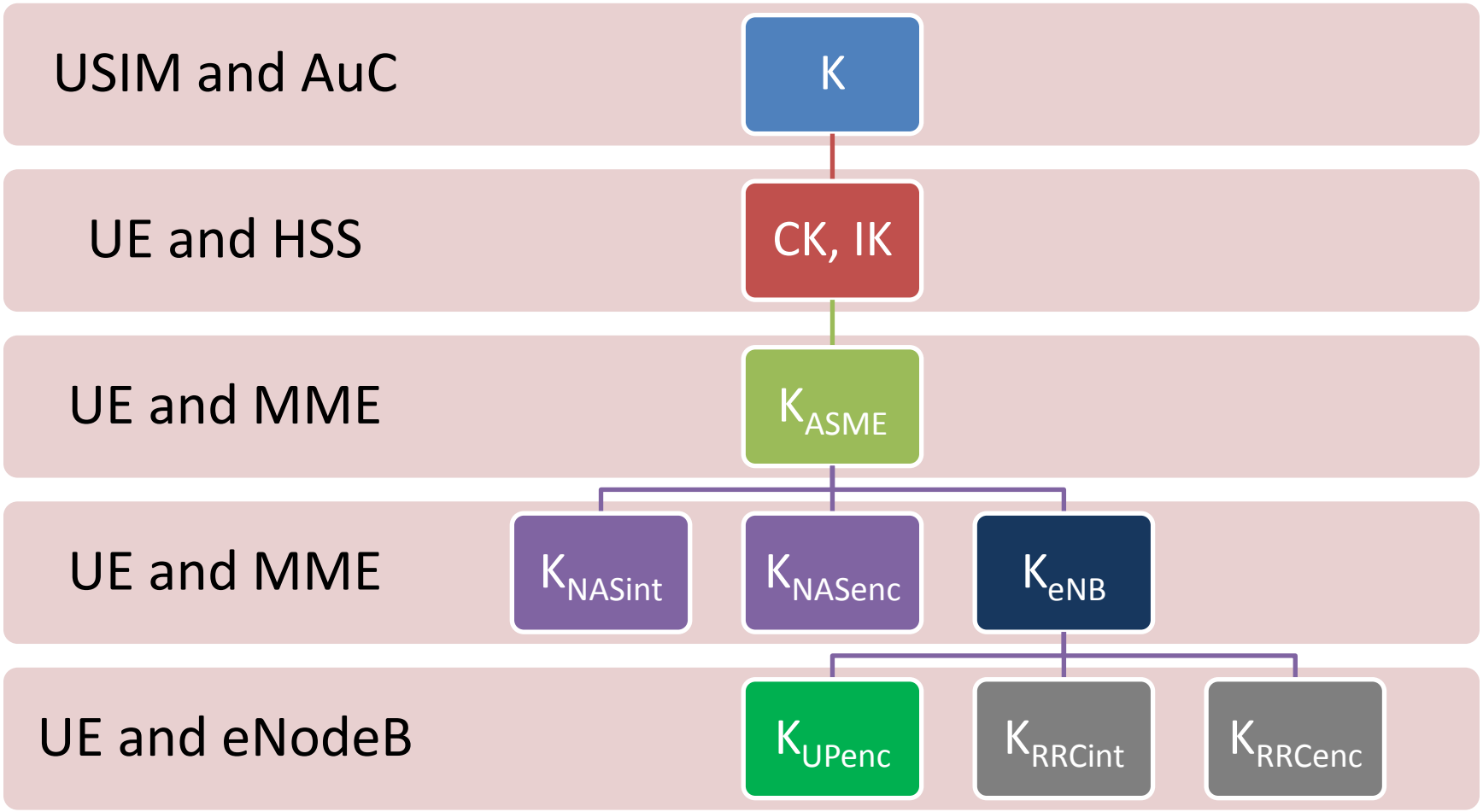
Integrity

- Signaling message receiver verifies that the received message is exactly the message that the transmitter sent
- This is done using an integrity checksum
- Guards against "man in the middle" attacks where the senders messages and intercepted by a hacker and a modified message is relayed to the receiver

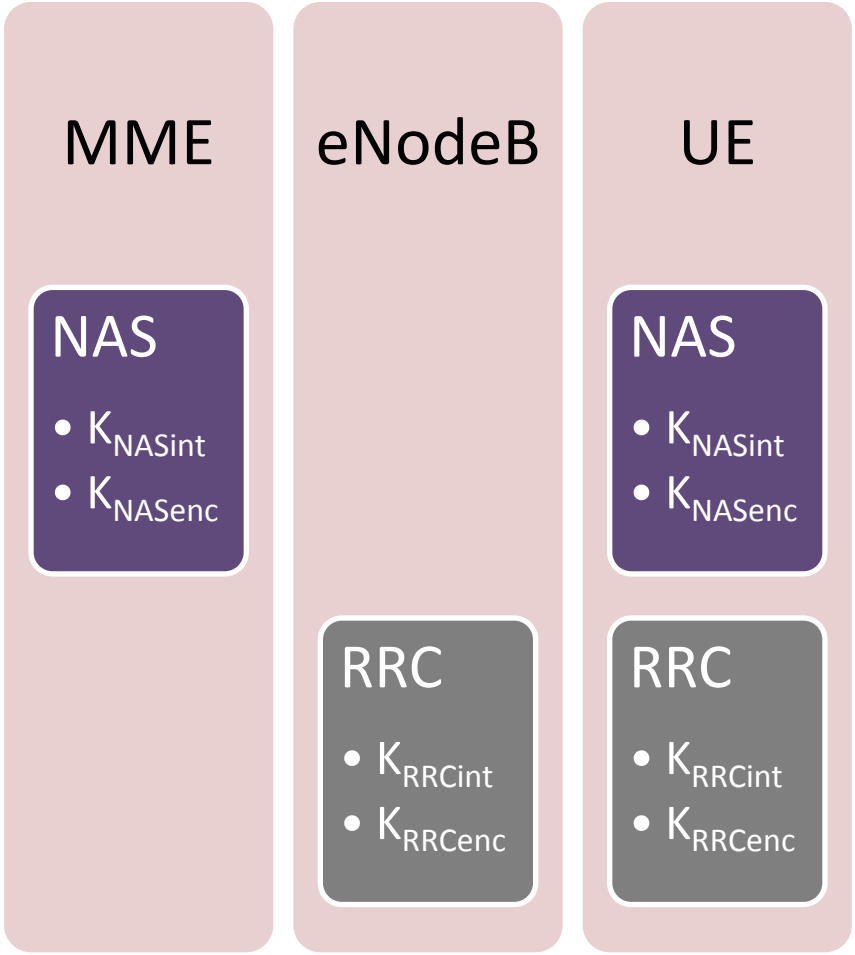
Encryption

- The sender encrypts the data with a secret key that is only known to the receiver
- Only the receiver is able to decode the message
- Guards against hackers listening in on the data

LTE Security Key Hierarchy

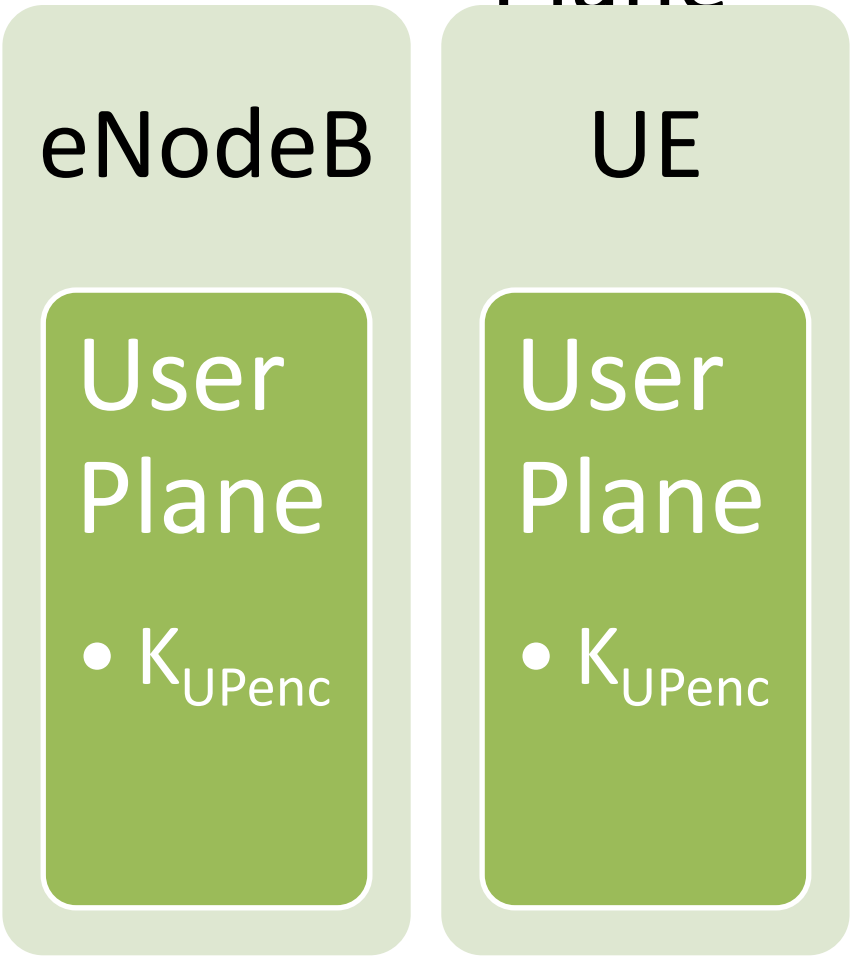


Encryption and Integrity Protection in the LTE Control Plan



- LTE supports two levels on security on the control plane
  - The NAS traffic between the MME and the UE is protected with NAS level keys
  - The RRC connection traffic between the MME and the UE is protected with RRC level keys
- This means that the NAS traffic is being protected with NAS as well as RRC level security

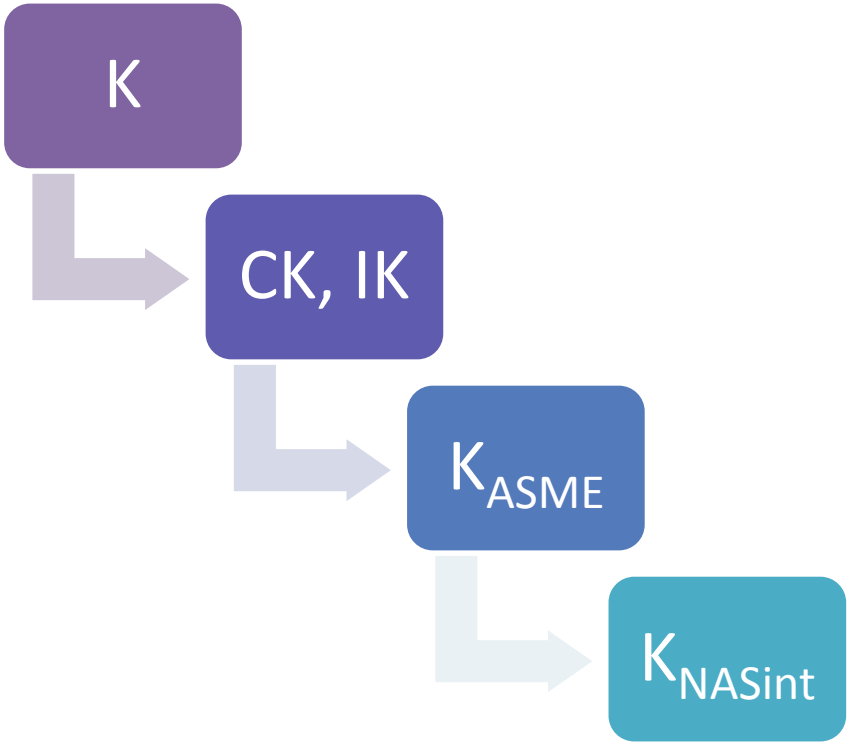
Encryption and Integrity Protection in the LTE User Plane



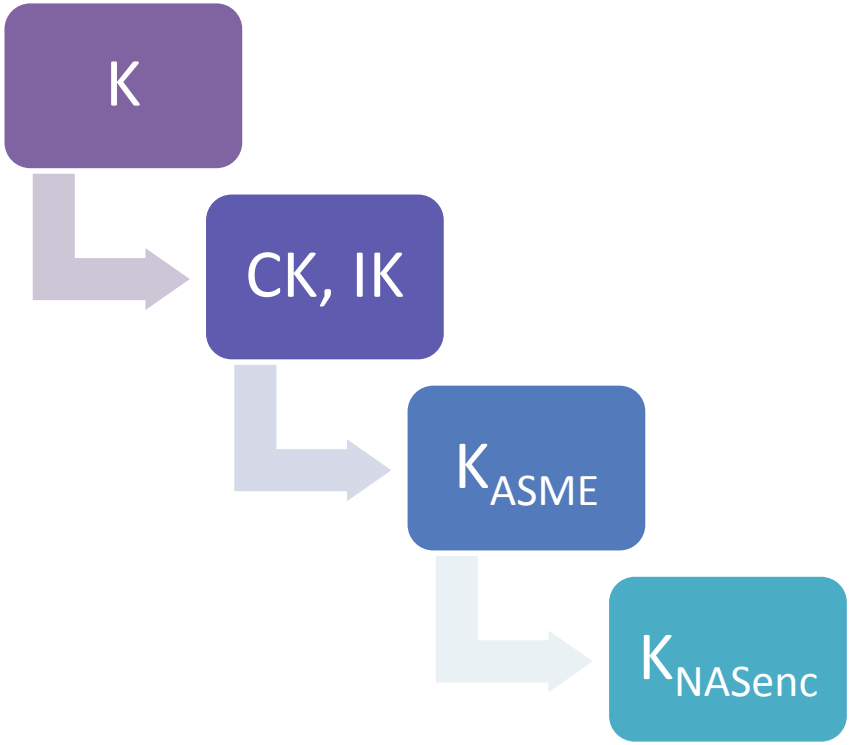
- User plane data is encrypted with the K_{UPenc} key

LTE NAS Key Derivation at the MME and UE

K_{NASint}: Integrity protection key for NAS signaling messages

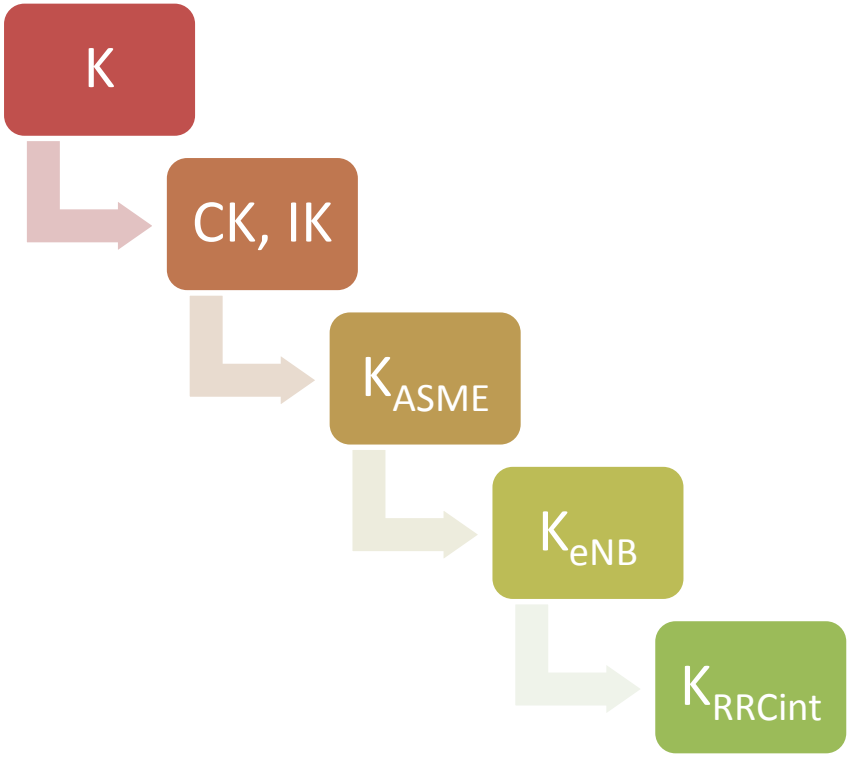


K_{NASenc}: Encryption key for NAS signaling messages

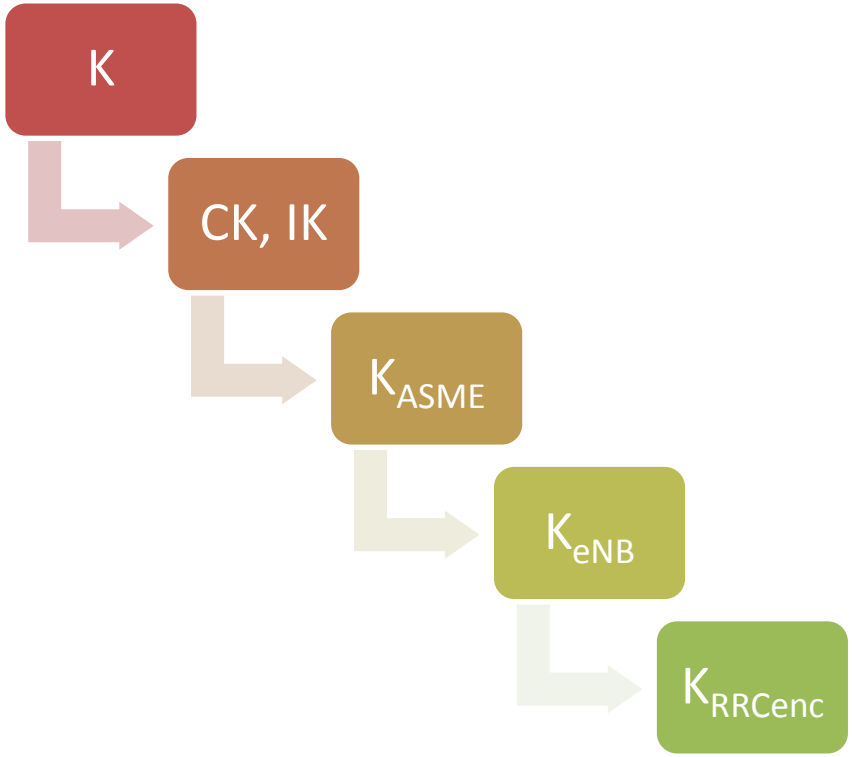


LTE RRC Key Derivation at the eNodeB and UE

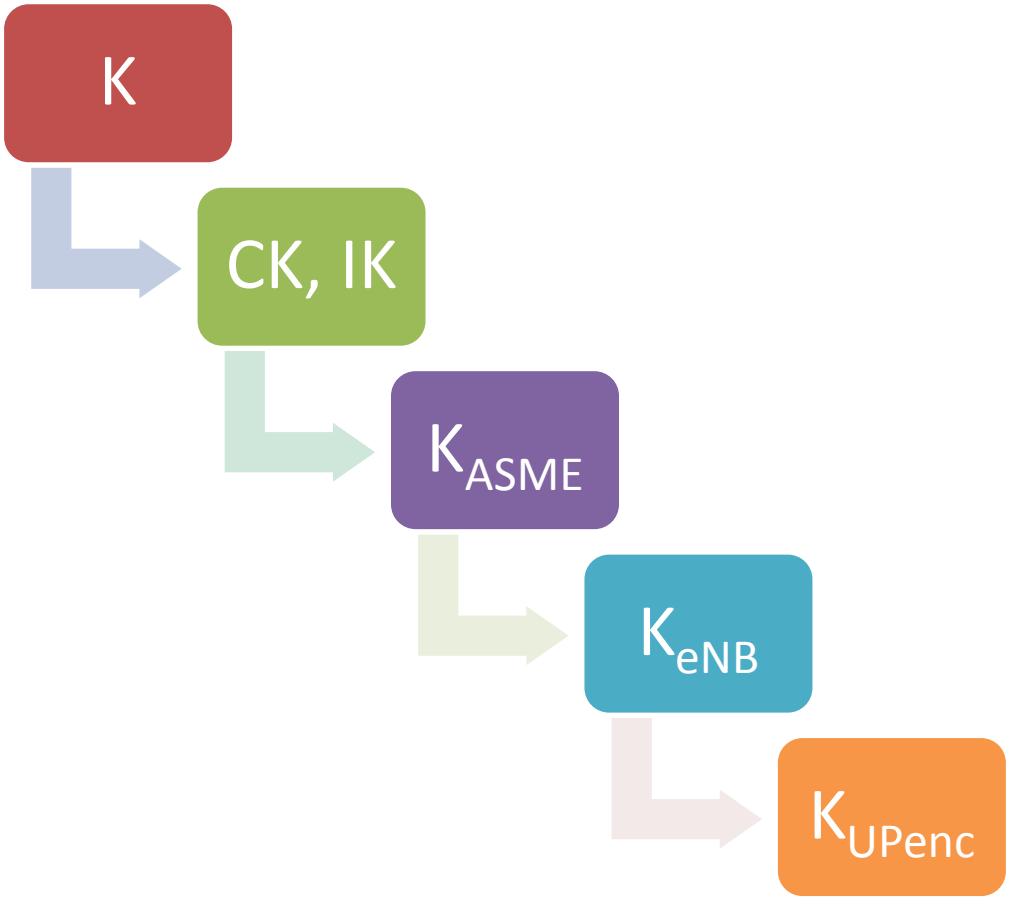
K_{RRCint}: Integrity protection key for RRC signaling messages



K_{RRCenc}: Encryption key for RRC signaling messages



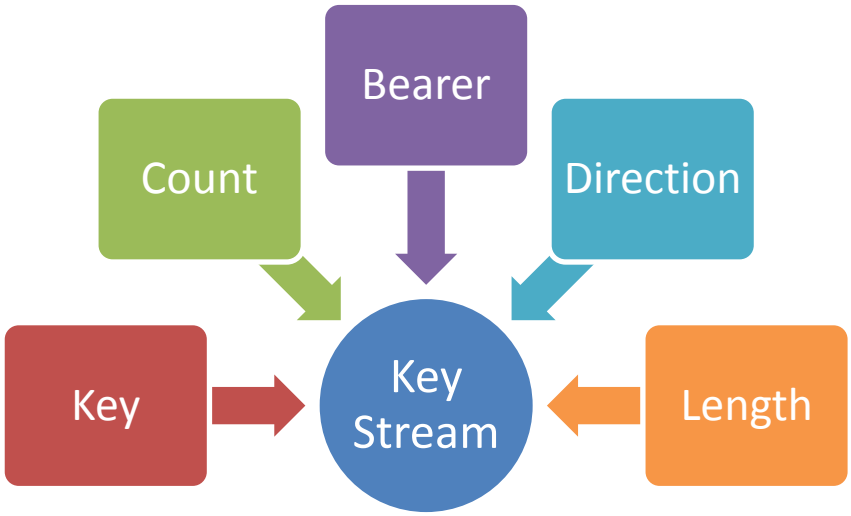
LTE User Plane Key Derivation at the eNodeB and UE



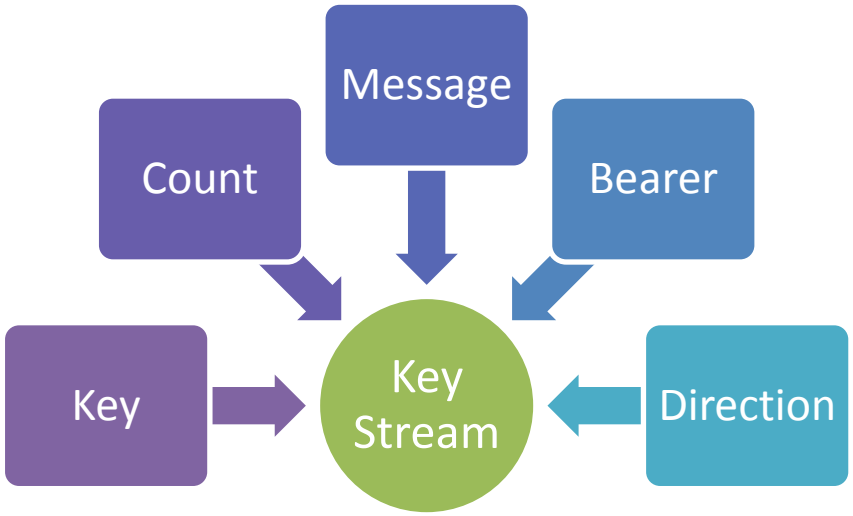
- K_{UPenc}: User plane encryption key

Key Stream Computation

Ciphering



Integrity Protection



3GPP Security Specifications

LTE Security

- 33.401: System Architecture Evolution (SAE); Security architecture
- 33.402: System Architecture Evolution (SAE); Security aspects of non-3GPP

Lawful Interception

- 33.106: Lawful interception requirements
- 33.107: Lawful interception architecture and functions
- 33.108: Handover interface for Lawful Interception

Key Derivation Function

- 33.220: GAA: Generic Bootstrapping Architecture (GBA)

Backhaul Security

- 33.310: Network Domain Security (NDS); Authentication Framework (AF)

Relay Node Security

- 33.816: Feasibility study on LTE relay node security (also 33.401)

Home (e) Node B Security

- 33.320: Home (evolved) Node B Security

Thank You

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Telecom Call Flows	GSM, SIP, H.323, ISUP, LTE and IMS call flows.
TCP/IP Sequence Diagrams	TCP/IP explained with sequence diagrams.
Telecom • Networking • Software	Real-time and embedded systems, call flows and object oriented design articles.