

S1AP View of LTE Attach & EPS Bearer Setup

This sequence diagram looks at the UE signaling from the S1AP vantage point. The following signaling is covered:

- (1) UE Attach, authentication and security signaling
- (2) Setup of two EPS Bearers (RAB id 5 and 6)
- (3) Release of UE context due to inactivity
- (4) Reestablishment of the UE context with a Service Request.

Click on any message title in this flow to see the complete message details.

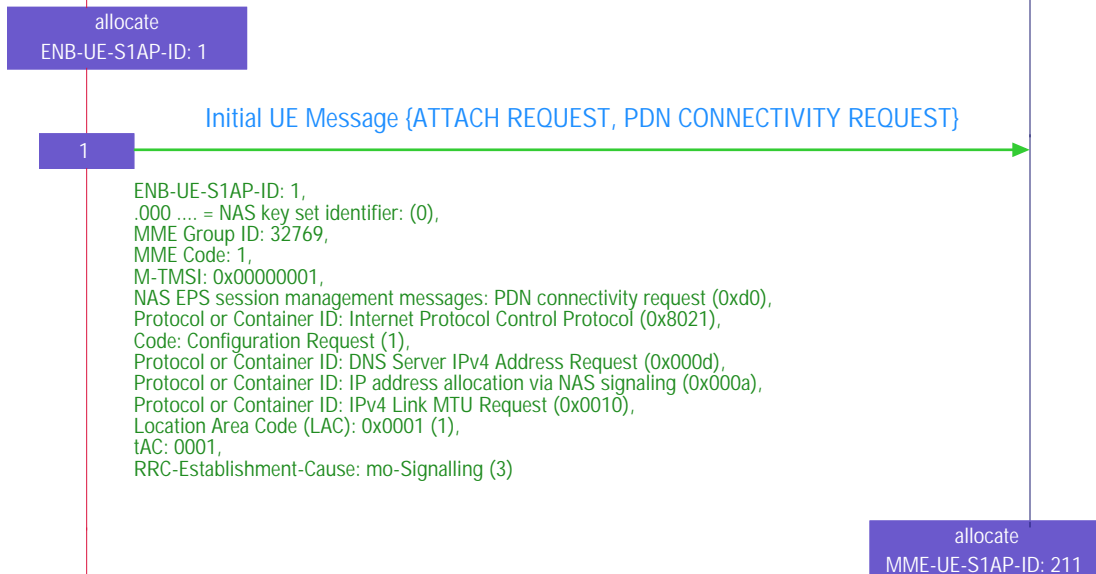
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Note: You can click on any message title in this flow to see complete field level details.

LTE Attach and Default EPS Bearer Establishment on a PDN

Register the UE with the Core Network and initiate the data service by setting up the default EPS Bearer.



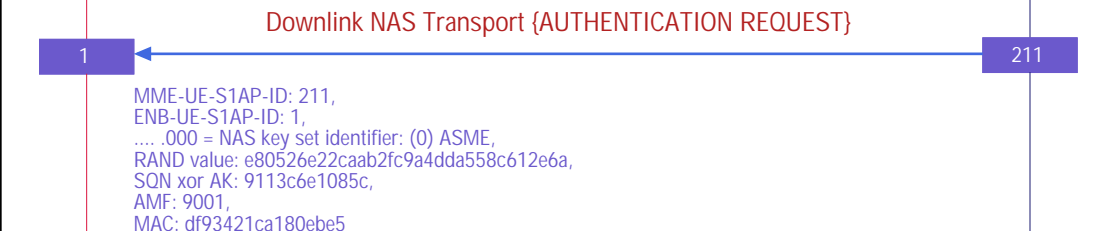
The eNodeB allocates 1 as the ENB-UE-S1AP-ID for the new session.

Initial UE Message contains an Attach Request and PDN Connectivity Request. The message contains UE specific information like the PLMN and Tracking Area. The message also contains information about the requested services. UE also sends ESM information transfer flag in the PDN CONNECTIVITY REQUEST message to signal that the APN will be sent after the encryption has been established.

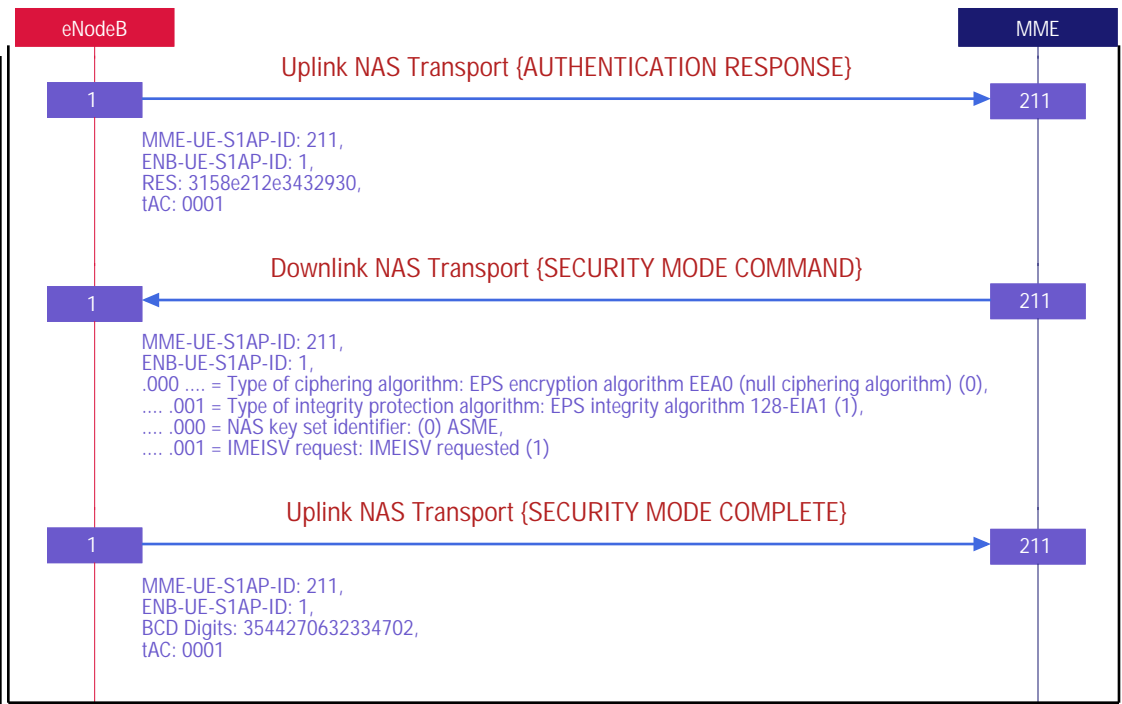
The MME allocates 211 as the MME-UE-S1AP-ID for the session.

Authenticate and Setup Encryption

The UE and the Network mutually authenticate each other. This is followed by setting up encryption.



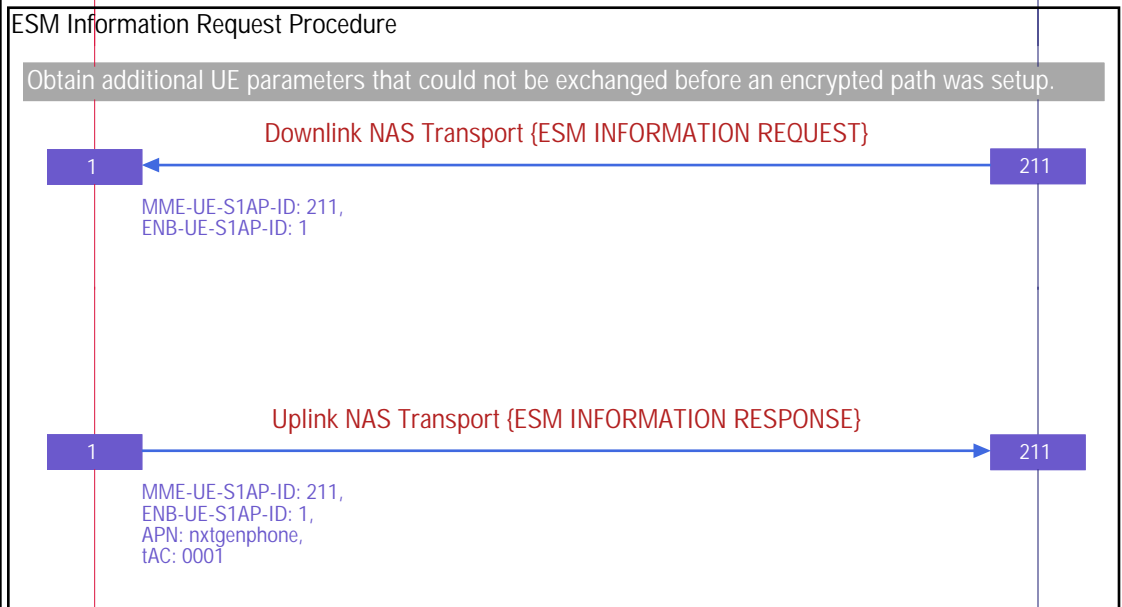
The MME sends an Authentication Request to the UE. The message contains the RAND and AUTN numbers. Key selection identifier (KSI-ASME) is also included in the message. This message is sent in the clear.



The UE sends the RES value back to the MME.

MME initiates the NAS security procedure. The encryption and integrity protection algorithms are included in the message. Key selection identifier (KSI-ASME) is also included in the message.

UE responds back to the MME. This message is sent with NAS ciphering and integrity protection.



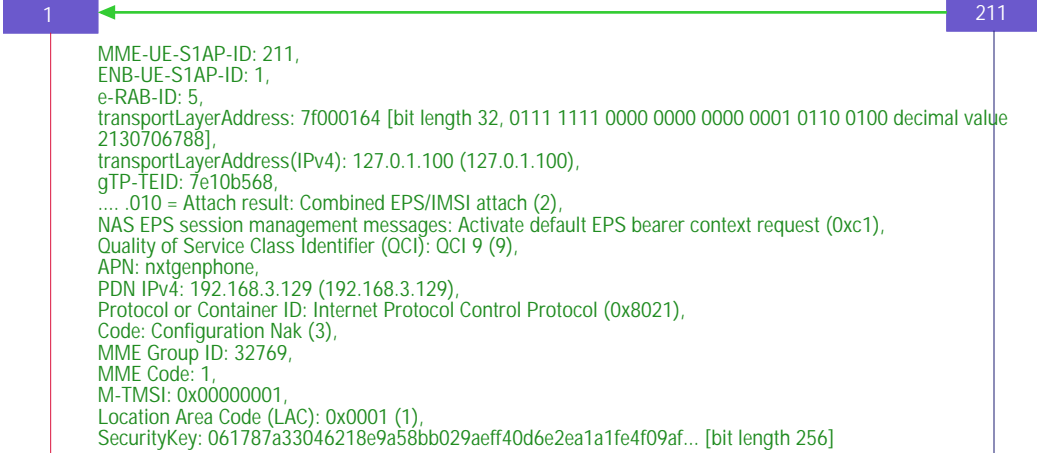
The ESM information request procedure is used by the network to retrieve protocol configuration options like APN etc. from the UE during the attach procedure. This procedure is used as the UE has indicated (in the PDN CONNECTIVITY REQUEST) that it has ESM information that needs to be sent with security.

The UE shall send an ESM INFORMATION RESPONSE message to the network. The UE shall include all the protocol configuration options that need to be transferred security protected.

Default EPS Bearer Establishment

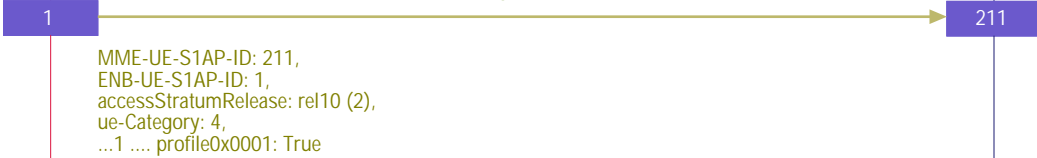
Setup the data service and assign an IP address to the UE. Also setup QoS parameters.

Initial Context Setup Request {ATTACH ACCEPT, ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST}



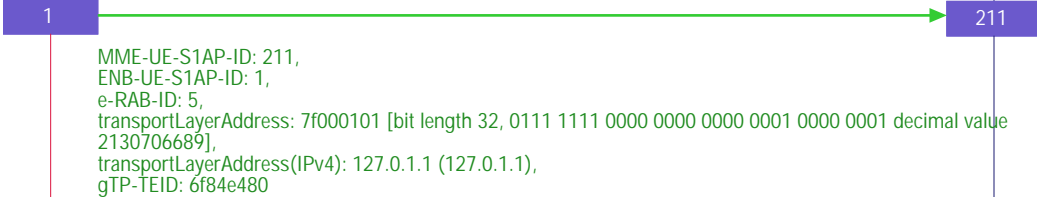
The MME responds with a combo message containing the Attach Accept and the Default Bearer establishment request. The bearer request specifies the QoS, APN and PDN information.

UE Capability Info Indication



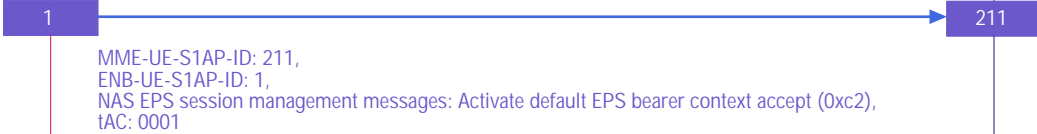
UE sends a detailed capability information message. This message specifies the hardware and software features of the UE.

Initial Context Setup Response [E-RAB Setup List Res]



The eNodeB responds back to the Initial Context Setup Request with details about the RAB establishment (eRAB id 5).

Uplink NAS Transport {ATTACH COMPLETE, ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT}

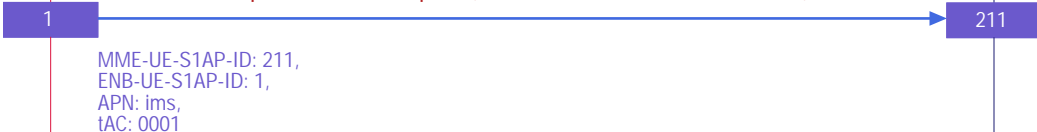


The eNodeB then transports the attach acceptance and the default EPS Bearer acceptance.

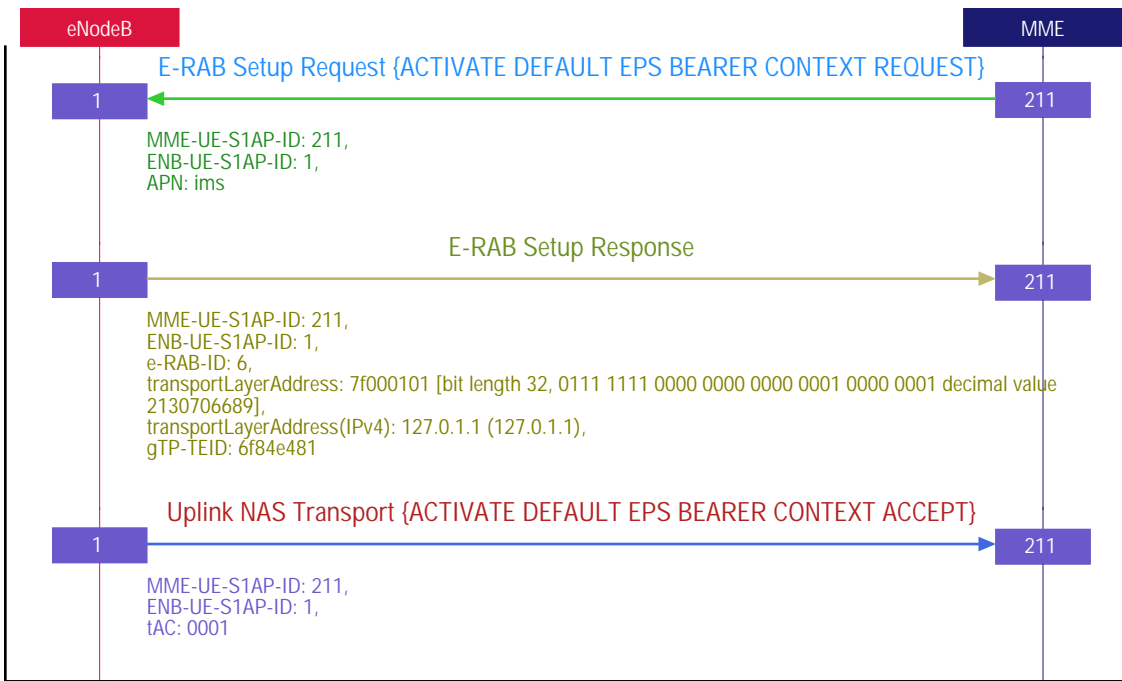
Connecting to a Second PDN and Activating the Default EPS Bearer for the PDN

The UE connects to a second Packet Data Network and establishes the Default Bearer for the second PDN.

Uplink NAS Transport (PDN CONNECTIVITY REQUEST)



The UE wishes to connected to a second PDN. The APN for the second PDN is included in the NAS message received from the UE.



The MME accepts the second PDN connectivity requests and initiates establishment of the Default EPS Bearer for the second PDN.

The eNodeB responds with details about the RAB establishment for the new RAB (eRAB id 6)

UE responds back with the establishment of the Default EPS Bearer for the second PDN.

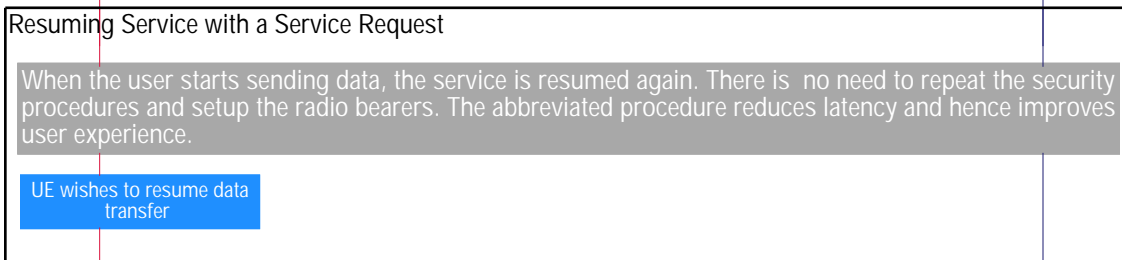
Data Transfer

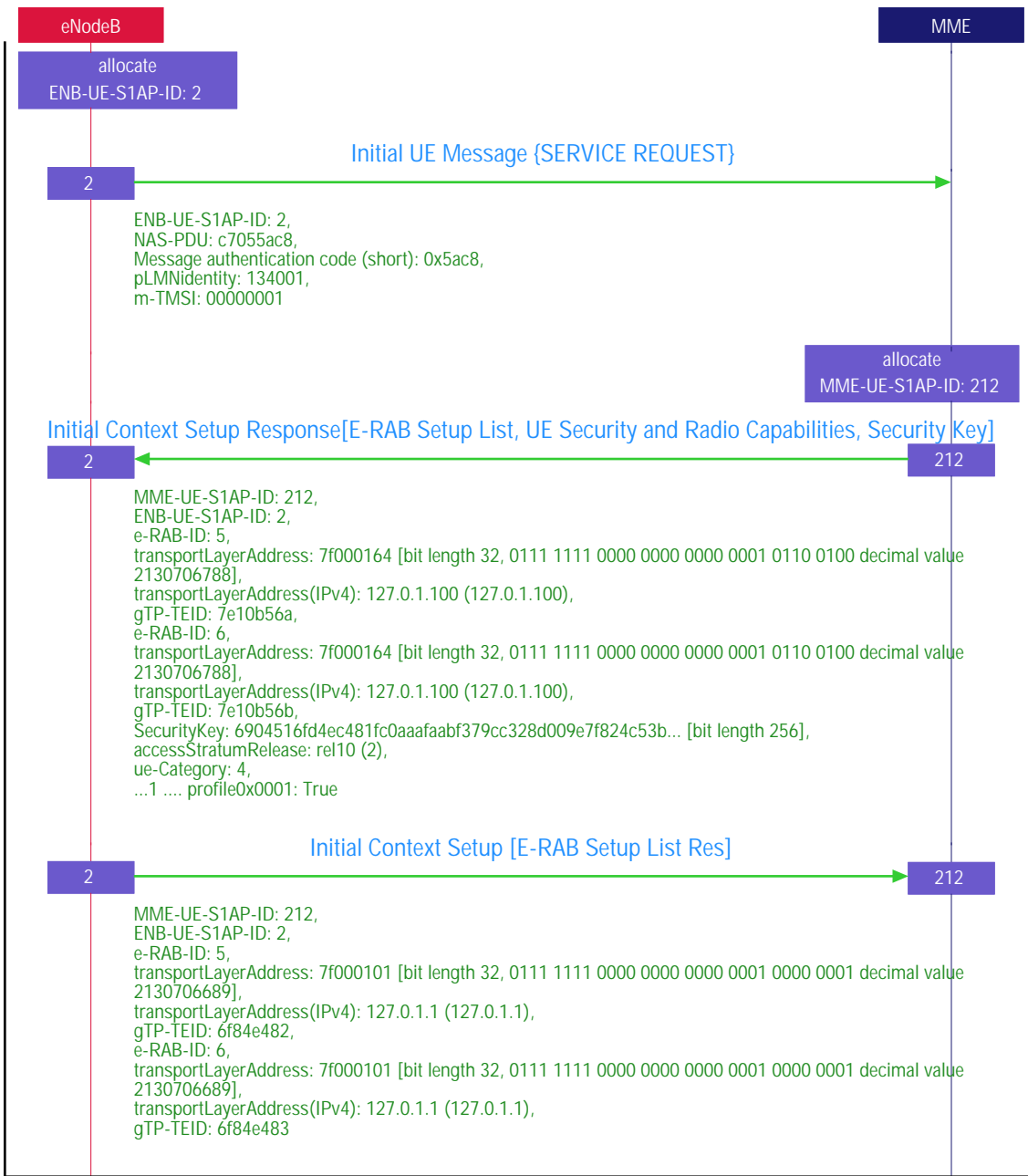


The data transfer has been completed. The eNodeB detects inactivity and requests the release of the UE context.

The MME initiates the UE context release.

The UE context has been released. Note that the default bearers are still present. Only the radio resources have been released.





The eNodeB allocates 2 as the ENB-UE-S1AP-ID for the new session.

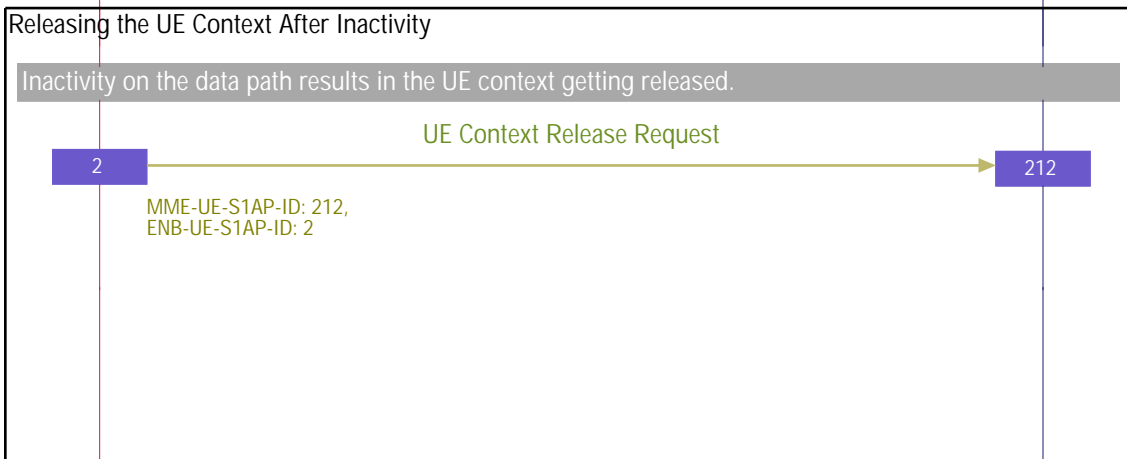
The Initial UE Message contains the Service Request message. The Service Request procedure resumes the existing bearers and encryption is setup without requiring additional security handshakes.

The MME allocates 212 as the MME-UE-S1AP-ID for the session.

The Initial Context Setup Response resumes the existing bearers. The UE security is also setup with the single handshake.

The eNodeB notifies the MME that the eRABs have been setup successfully.

Data Transfer



Releasing the UE Context After Inactivity

Inactivity on the data path results in the UE context getting released.

UE Context Release Request

MME-UE-S1AP-ID: 212,
ENB-UE-S1AP-ID: 2



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