

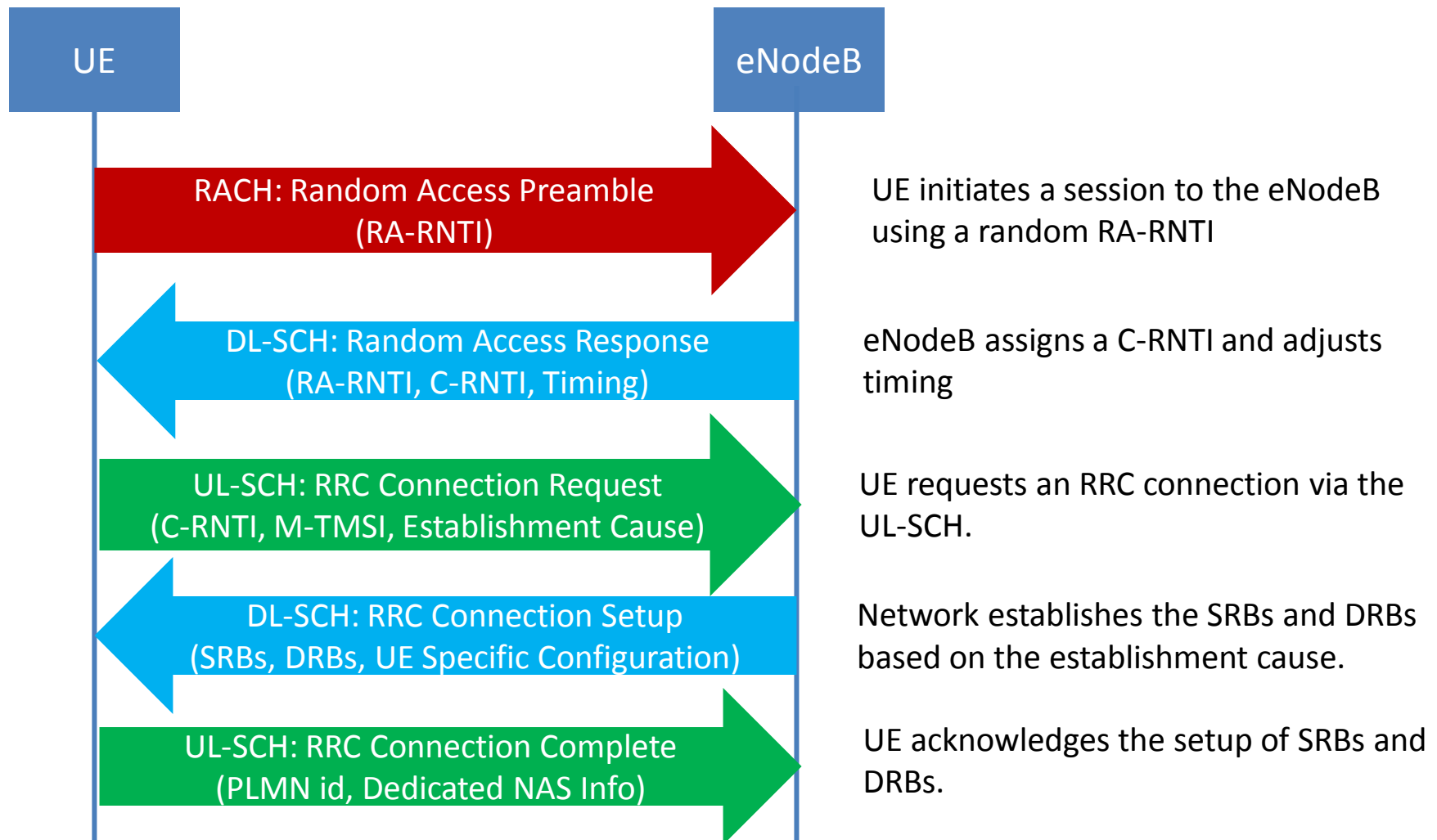
# LTE RRC Connection Setup Messaging

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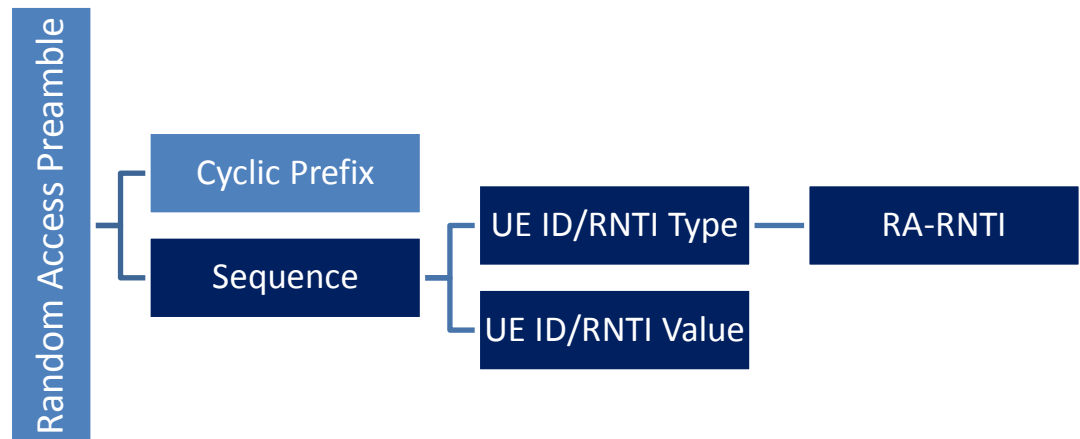
# LTE attach message sequence chart

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- systems engineering
- real-time and embedded systems



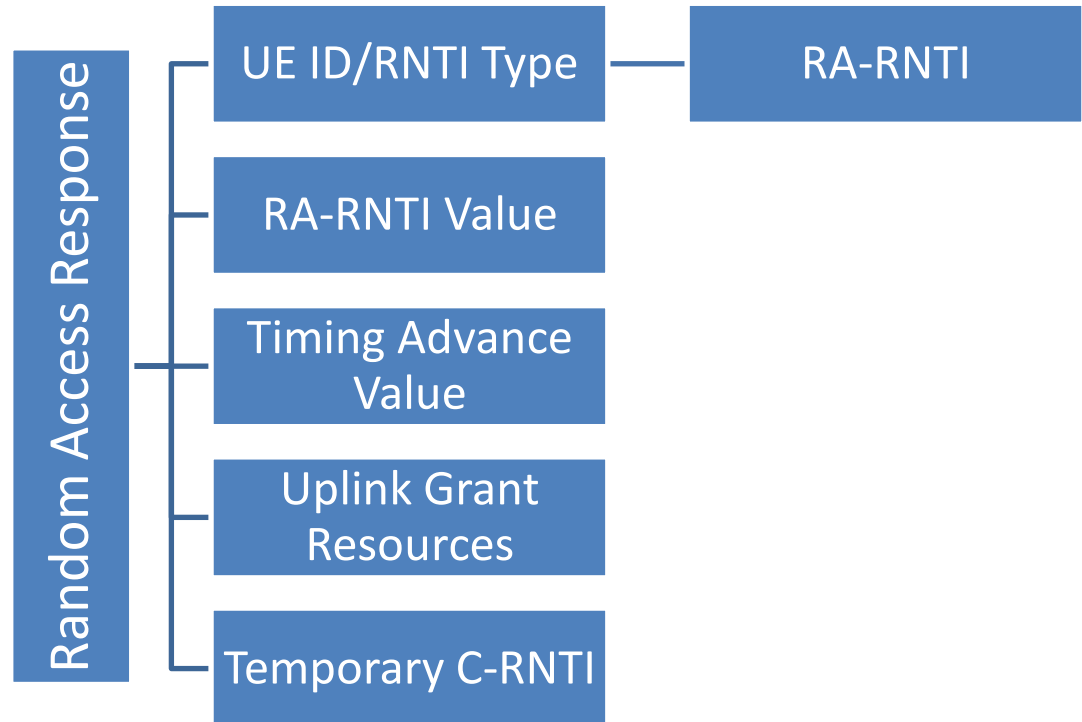
## RACH: UE → eNodeB: Random Access Preamble

- The terminal picks a preamble to send the random access message
  - The preambles in LTE are defined from a Zadoff-Chu sequence
- The preamble consists of the cyclic prefix and a sequence
- The sequence identifies the UE that is initiating the random access
  - The type of the UE and the UE ID value are included in the message
- RA-RNTI is used as a temporary identifier during the random access procedure



## DL-SCH: UE ← eNodeB: Random Access Response

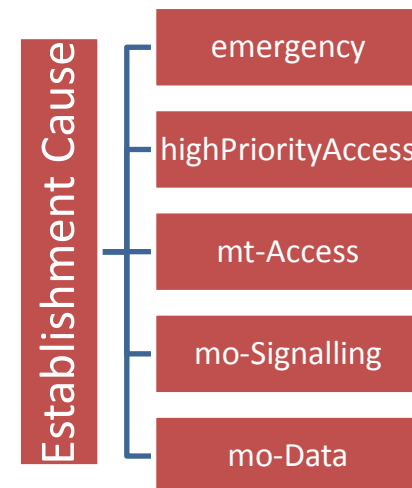
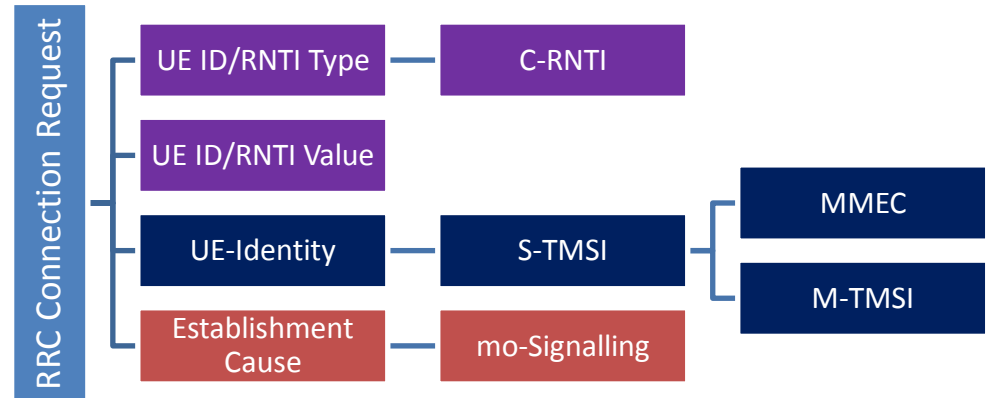
- The eNodeB responds with a Random Access Response on the DL-SCH channel
- The UE is addressed with the RA-RNTI that was sent in the Random Access Preamble
- The message carries a Timing Advance that is used to adjust the UE transmitter timing
  - This adjustment will synchronize the UE transmitter so that the transmissions from the UE are received within the receive timing window
- The message may carry an uplink resource assignment
- The message also assigns a C-RNTI that will be used to address the UE



## UL-SCH: UE → eNodeB

### RRC Connection Request

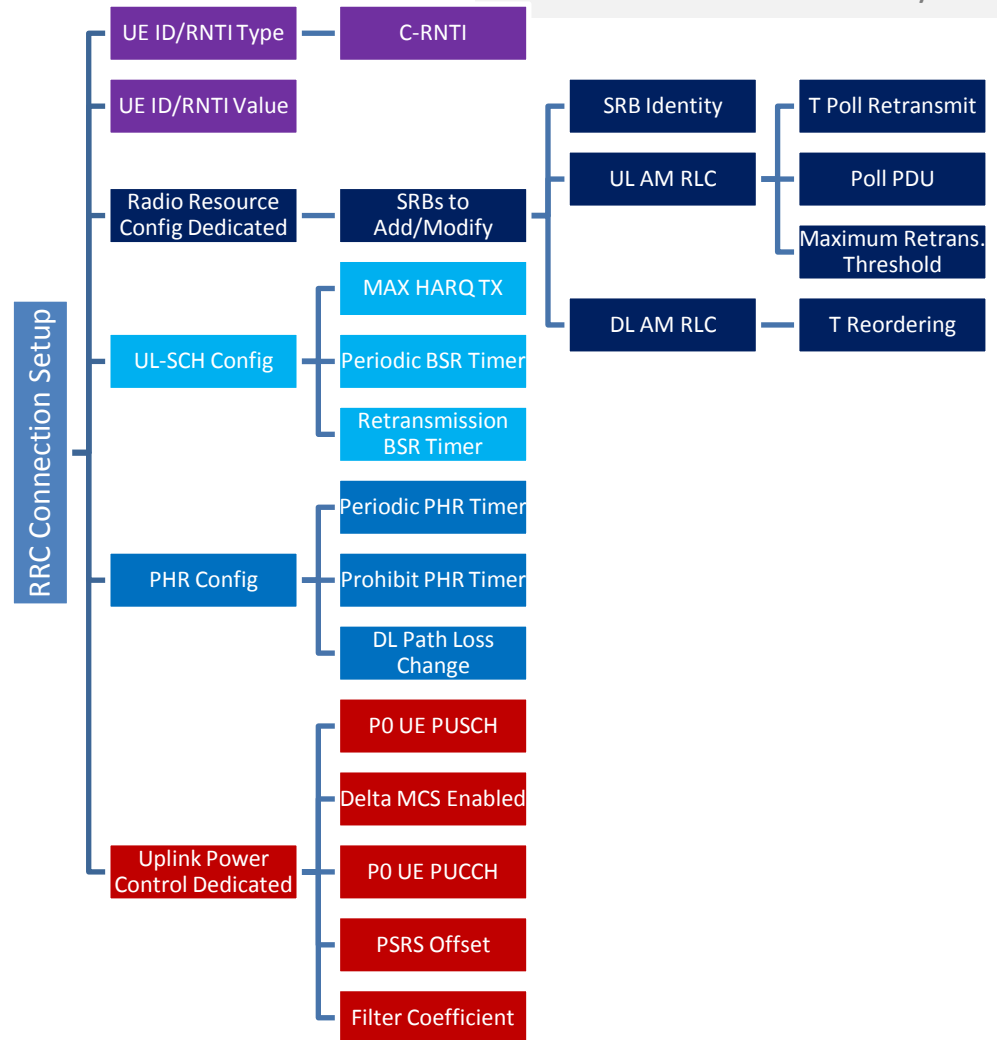
- The UE has received the Random Access Response based on the RA-RNTI.
  - The Random Access Response assigns a C-RNTI and resources for transmission of the RRC Connection Request
- The message identifies the UE with the C-RNTI
- The message contains the UE-Identity
  - IMSI is sent in the message if this is the first attach to the network
  - If the terminal had attached previously, the S-TMSI is included in the message
- The message also contains the establishment cause.
  - In this example, the RRC Connection Request is sent with “Mobile Originated Signaling” cause.
- Note that the eNodeB may optionally send a contention resolution message on receipt of this message



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## DL-SCH: UE ← eNodeB RRC Connection Setup

- The message identifies the signaling radio bearer (SRB)
- The configuration parameters carried in the message are described in the next two slides



# RRC Connection Setup Configuration - 1

## RLC Uplink Configuration

- Timer for status report polling
- Number of retransmissions of buffer status report
- Control plane retransmission limit

## RLC Downlink Configuration

- The maximum time to wait for packet reordering

## UL-SCH configuration

- Maximum number of Hybrid ARQ transmissions
- Periodic and regular buffer status report (BSR) timer

# RRC Connection Setup Configuration - 2

## Power Headroom Report (PHR) Configuration

- Periodicity of the PHR
- Downlink Path Loss more than the specified value also triggers PHR (provided the Prohibit PHR timer has expired)

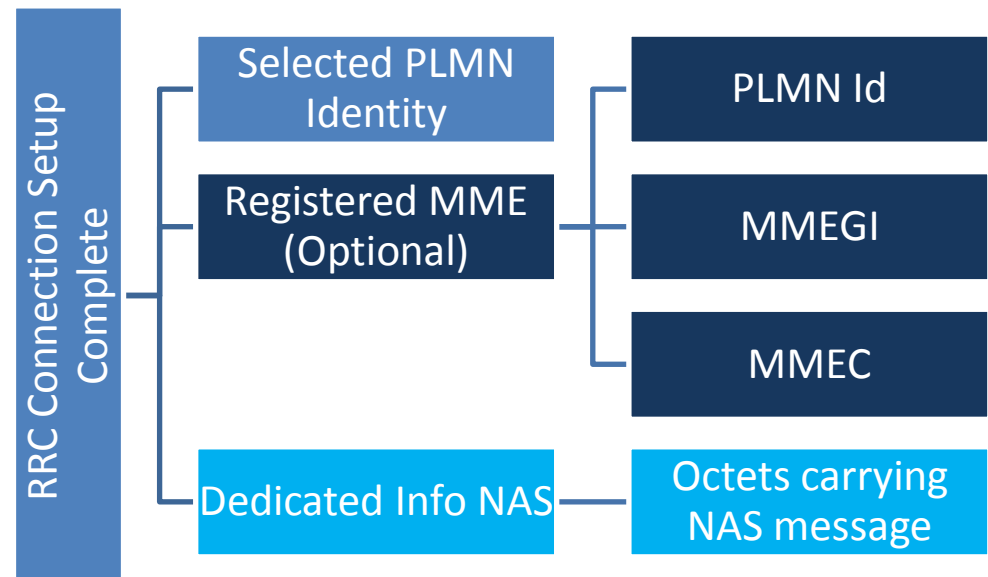
## Uplink Power Control Parameters

- $P_0$ -UE-PUSCH and  $P_0$ -UE-PCCH values are used to determine the nominal power of the uplink transmissions
- “pSRS Offset” determines the uplink Sounding Reference Signal power
- Delta MCS (choose between  $K_s = 0$  and  $K_s = 1.25$ )
- Filter Coefficient value for RSRP (Reference Signal Received Power) measurement used to calculate path loss
- Reference: 36.213 clause 5.1.1.1



## UL-SCH: UE → eNodeB RRC Connection Setup Complete

- UE sends this message on receipt of the RRC Connection Setup message
- “Dedicated Info NAS” is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for this information.
- The message may optionally contain registered MME
- The RRC Connection Setup Complete may also carry octets for a NAS message exchanged between the UE and the MME



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# Explore more

Links	Description
<a href="#">3GPP 36.331 RRC Specifications</a>	Radio Resource Control (RRC); Protocol specification
<a href="#">EventStudio System Designer</a>	Sequence diagram based systems engineering tool.
<a href="#">VisualEther Protocol Analyzer</a>	Wireshark based visual protocol analysis and system design reverse engineering tool.
<a href="#">Telecom Call Flows</a>	GSM, SIP, H.323, ISUP, LTE and IMS call flows.
<a href="#">TCP/IP Sequence Diagrams</a>	TCP/IP explained with sequence diagrams.
<a href="#">Telecom • Networking • Software</a>	Real-time and embedded systems, call flows and object oriented design articles.
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