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- telecommunication design
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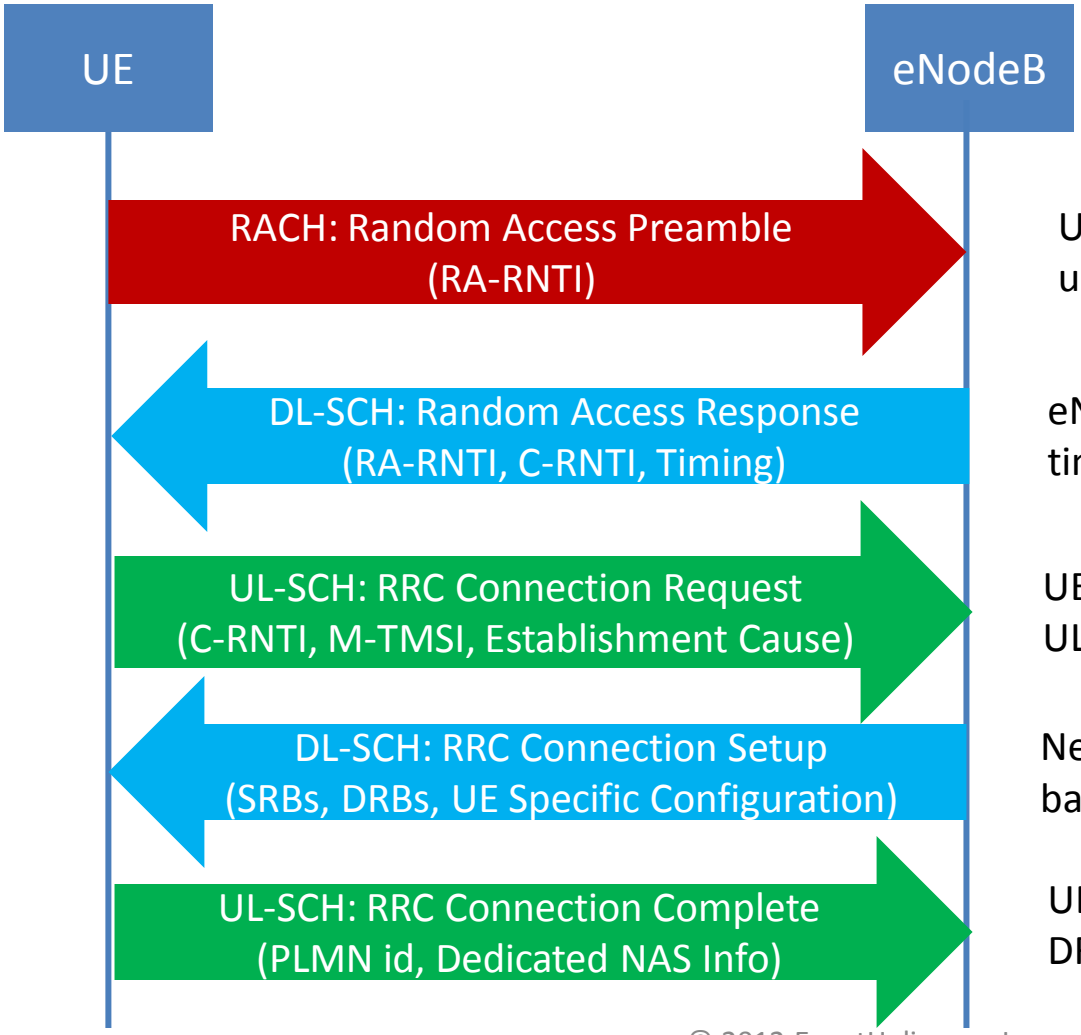
LTE RRC Connection Setup Messaging

LTE attach message sequence chart



UE initiates a session to the eNodeB using a random RA-RNTI

eNodeB assigns a C-RNTI and adjusts timing

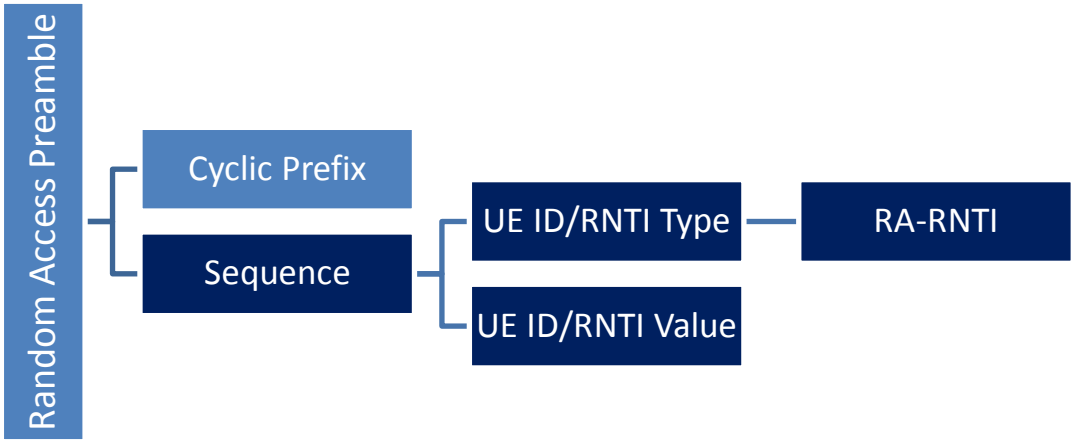
UE requests an RRC connection via the UL-SCH.

Network establishes the SRBs and DRBs based on the establishment cause.

UE acknowledges the setup of SRBs and DRBs.

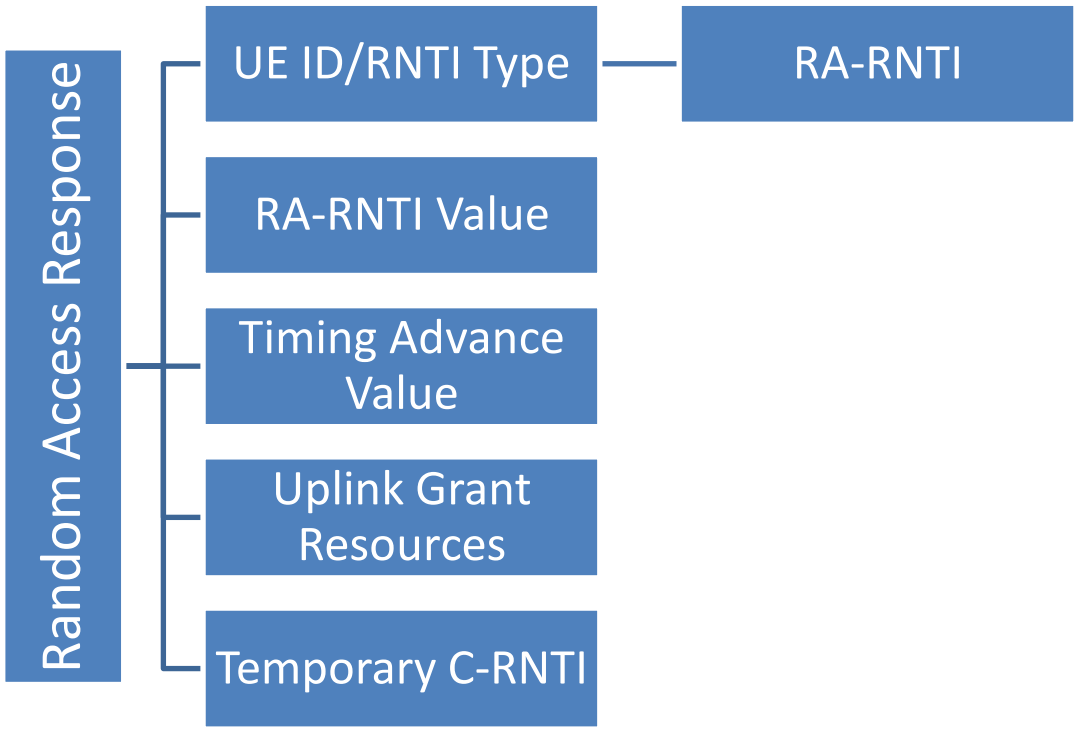
RACH: UE → eNodeB: Random Access Preamble

- 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



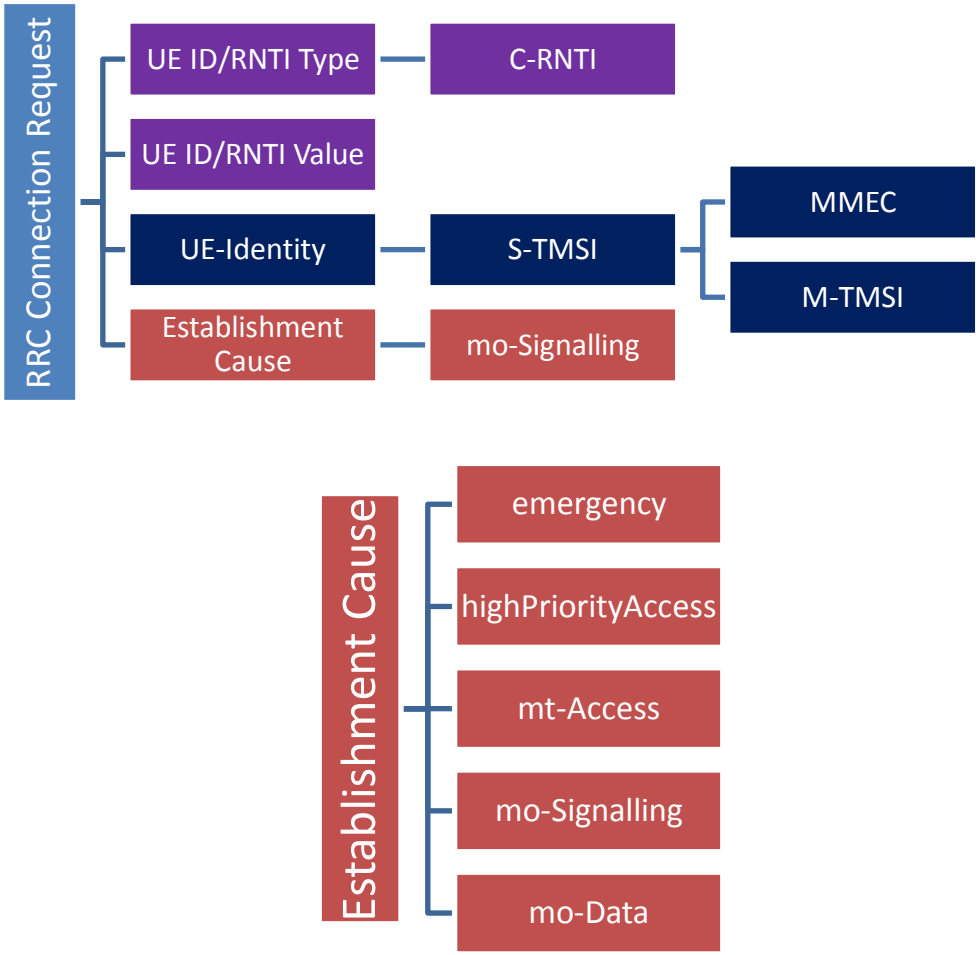
DL-SCH: UE ← eNodeB: Random Access Response

- 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



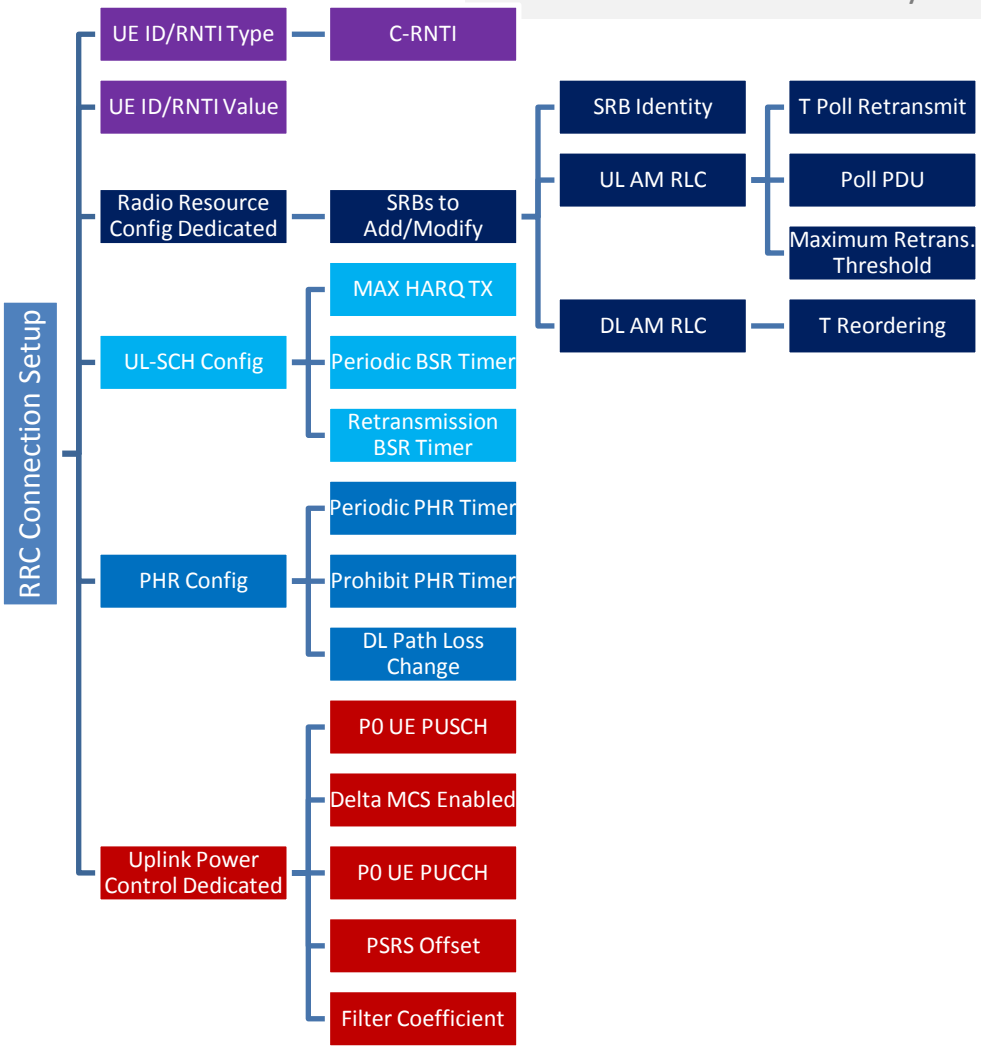
UL-SCH: UE → eNodeB
RRC Connection Request

- 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



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

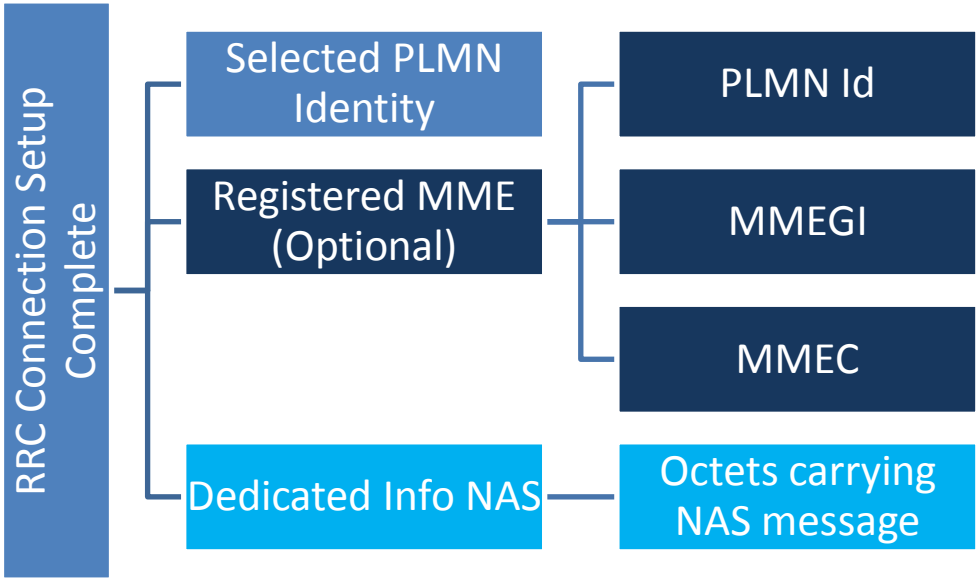
- Periodicity of the PHR
- Downlink Path Loss more than the specified value also triggers PHR (provided the Prohibit PHR timer has expired)

Uplink Power Control Parameters

- P0-UE-PUSCH and P0-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 Ks = 0 and Ks = 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



Explore more

Links	Description
3GPP 36.331 RRC Specifications	Radio Resource Control (RRC); Protocol specification
EventStudio System Designer	Sequence diagram based systems engineering tool.
VisualEther Protocol Analyzer	Wireshark based visual protocol analysis and system design reverse engineering tool.
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.
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