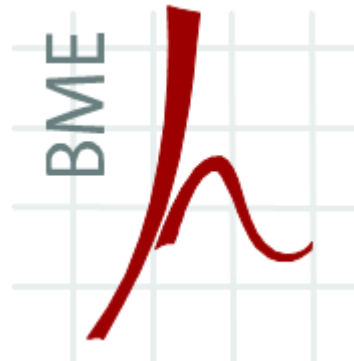# Mobile infocommunication systems
# Mobile infocommunication networks
- 3G UMTS system –
- 3G UMTS air interface basics -

2016. október 19., Budapest

NETWORK ARCHITECTURE

3G basics

- network
  - to ensure CS (voice call, video call) and PS services (data, Internet access)
  - to use the existing GSM/GPRS infrastructure as much as possible
- radio interface
  - completely new air interface, based on new method
  - WCDMA: Wideband Code Division Multiple Access
  - as the radio interface is new, new radio network (network of base stations) is needed
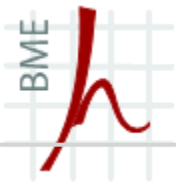
Network

- **UE user equipment** two main parts: USIM (UMTS Service Identity Module) and ME (Mobile Equipment), Cu interface between them
- **UTRAN (Universal Terrestrial Radio Access Network)**, this is the radio network, containing
  - Node B: the base stations
  - RNC: Radio Network Controller: a big capacity central device
 - **Core Network, CN**

Architecture

- UTRAN:
  - composed of RNSs Radio Network Systems
  - one RNS contain an RNC and the Node Bs controlled by the RNC
  - the RNC –s are connected to each other through the Iur interface
  - the RNC – NodeB interface is called Iub
- RNC –s are connected to the Core Network through the Iu interface
- Core Network:
  - inherited from GSM/GPRS
  - **MSC**, **GMSC** from GSM, this is the CS domain
  - **SGSN**, **GGSN** from GPRS, for serving packet data
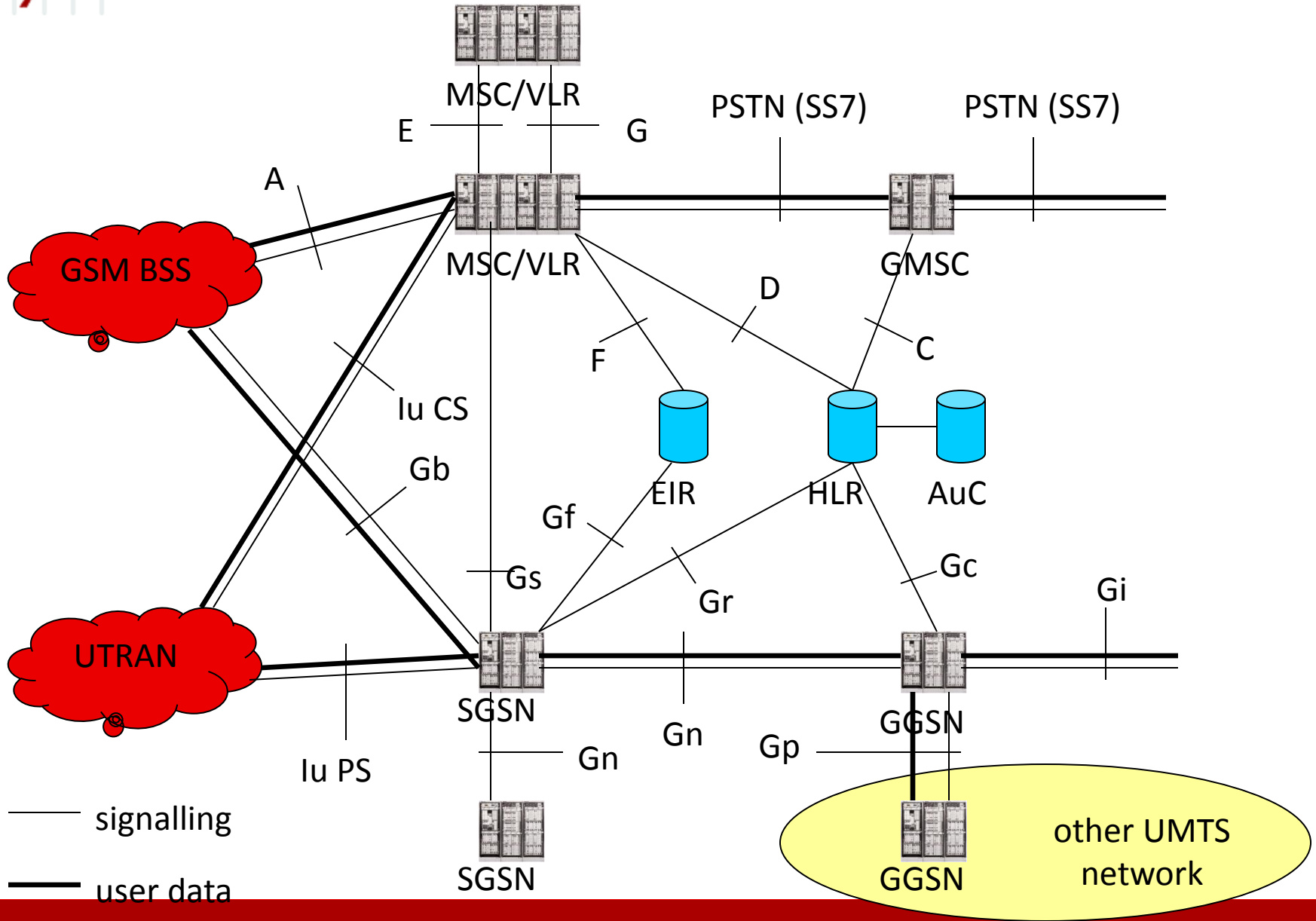 - and supporting databases: **VLR, HLR, AuC, EIR**

Architecture
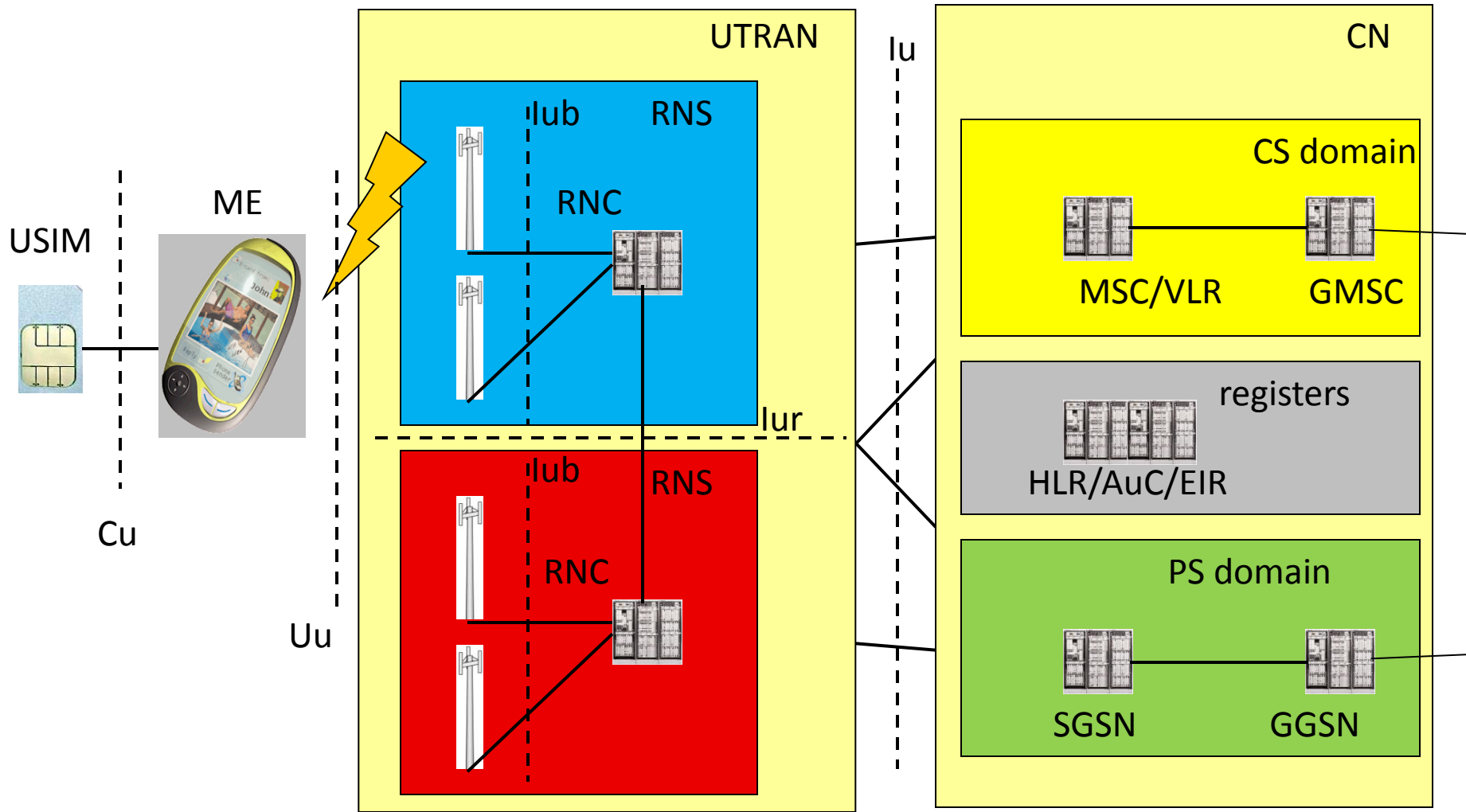
GSM/GPRS - UMTS network

UMTS network

UTRAN
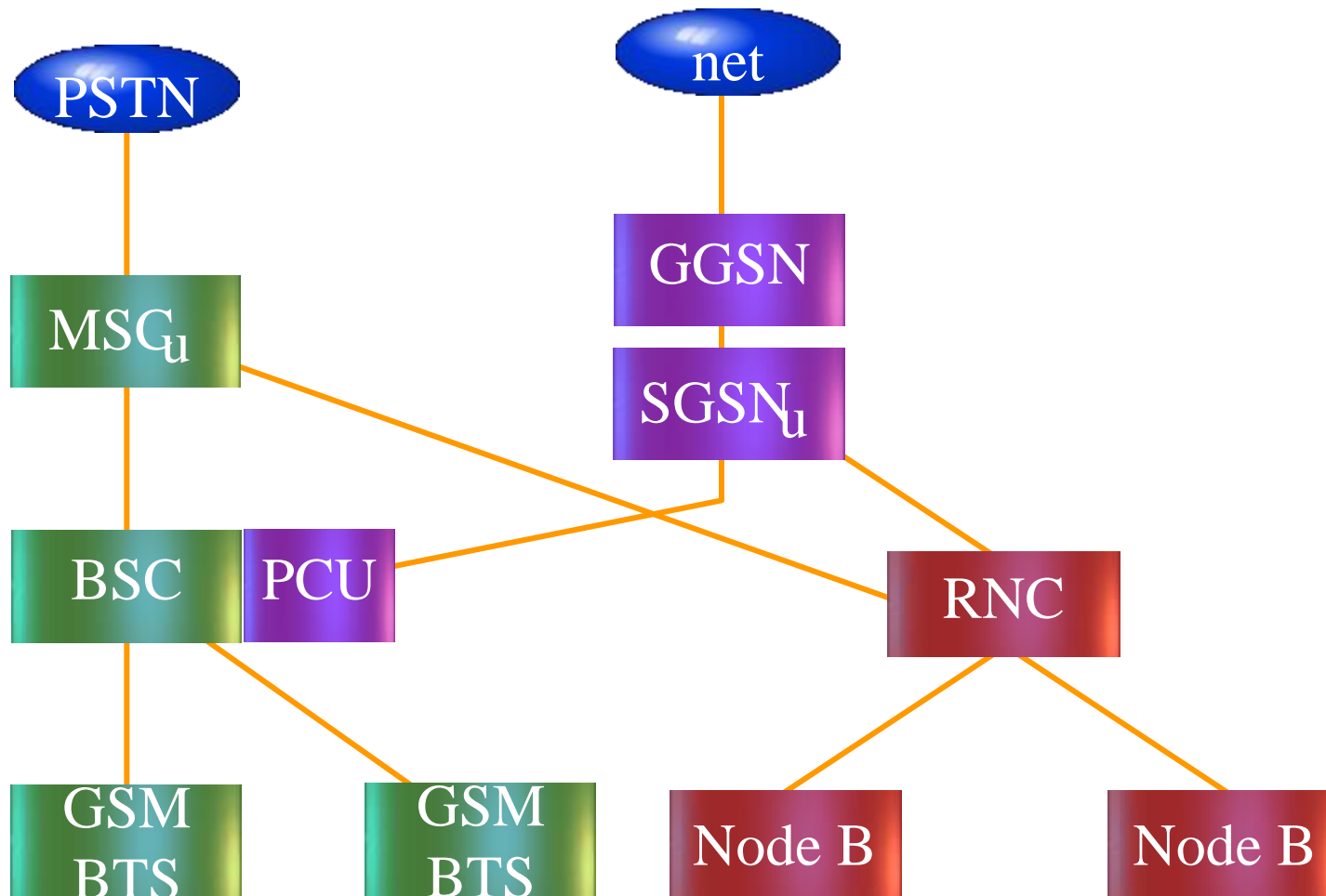
- main rolea: to provide radio access of UEs to the CN
- new devices:

  - **Node B** – role is equivalent to that of the BTS in GSM, but completely new hardware devices are needed

  - new modulation, new access method, new bands, new bandwidth

  - role: physical layer processing of signals

  - in simple terms: translate to/from the radio signal from/to wired signal

  - it does not „understand" what the mobile sends, it just translates the signal and forwards it
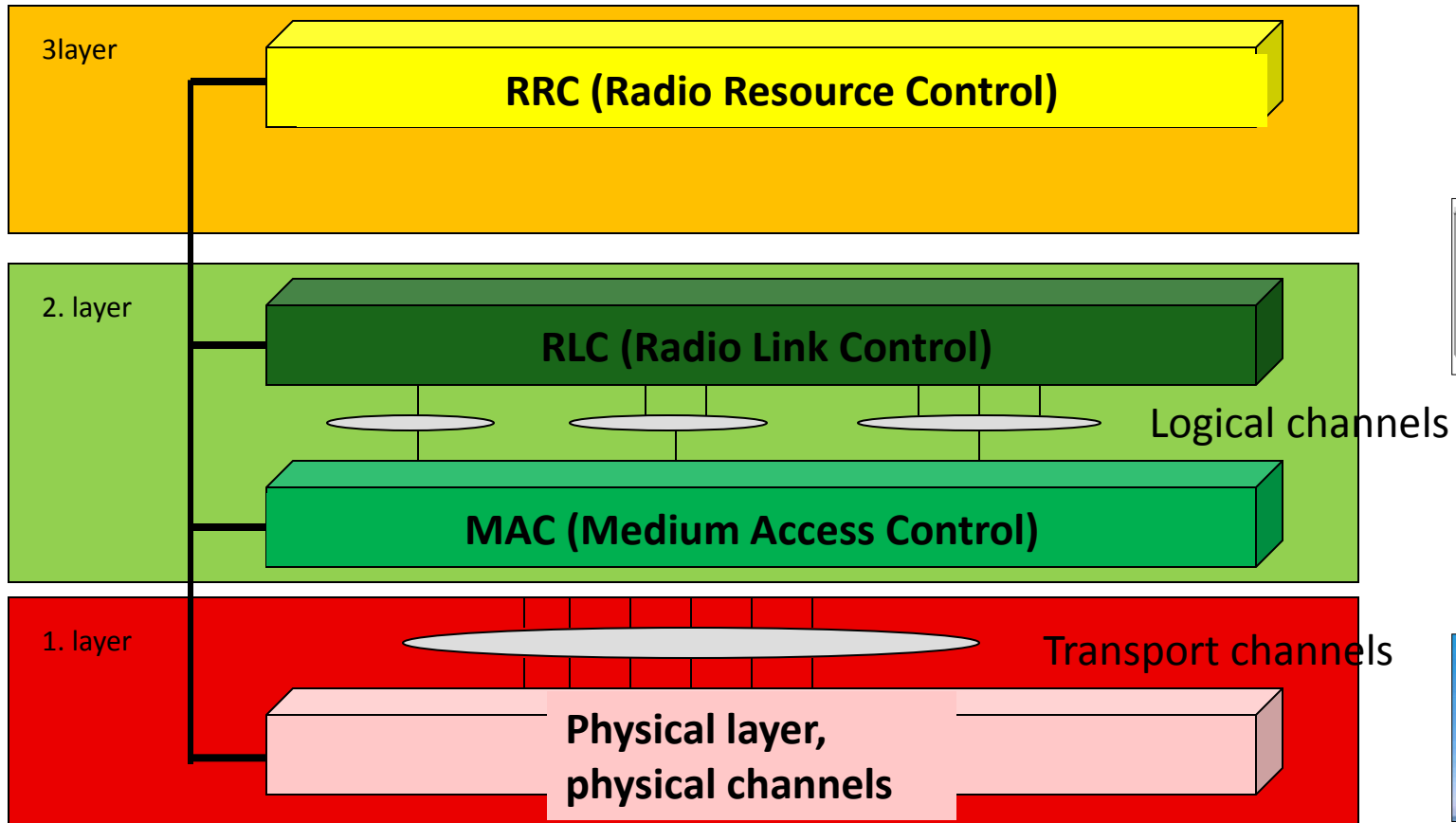
UTRAN

- **main novelties on radio**
  - CDMA access
  - 5 MHz channel bandwidth
  - new bands around 2100 MHz
  - duplexing modes can be FDD, TDD
- **roles of Node B**

  - modulation, synchronisation, CDMA coding
  - error correction coding, bit interleaving, scrambling
  - encryption of signal
  - fast transmit power control

UTRAN

- RNC, Radio Network Controller
  - its role is similar to that of GSM BSC
  - controlling a number of NodeBs
  - forwarding user data to/from base stations
- radio resource management (RRM):
  - basic power allocation (for radio channels), allocation of codes, scheduling of timeslots, frames, logical/transport and physical channels
- mobility management
  - control of handover, admission control, control and scheduling of paging messages
    - soft handover possible: the UE is communicating with two or more base stations for a while
      - it does not loose connection, as connection to new cell is set up before it terminates the connection to previous cell
- macro diversity
  - in case of soft handover, the data stream is arriving to RNC twice (through the two cells or base stations). RNC can combine the two streams and can minimise loss of data
- broadcasting system information

Radio protocols

3layer

RRC (Radio Resource Control)

2. layer

RLC (Radio Link Control)

Logical channels

MAC (Medium Access Control)

1. layer

Transport channels

Physical layer, physical channels

Radio protocols

- RRC: Radio Resource Control
  - setting up radio connection - radio bearers
  - broadcasting system information
  - control plane protocol for radio connection
- RLC Radio Link Control
  - framing, creating RLC packets
  - logical channel: a given stream of RLC packets
  - ordered delivery of RLC packets, avoiding duplications
  - retransmissions, acknowledgements
- MAC Medium Access Control
  - distribute the channel among logical channels
  - control who can access the channel when, how and in what format
- these protocols has endpoint in the RNC and in the UE
- UE is in radio connection with the RNC
  - UE traffic is acknowledged and retransmitted by the RNC