

Mobilné dátové siete

GSM/GPRS/EDGE/UMTS

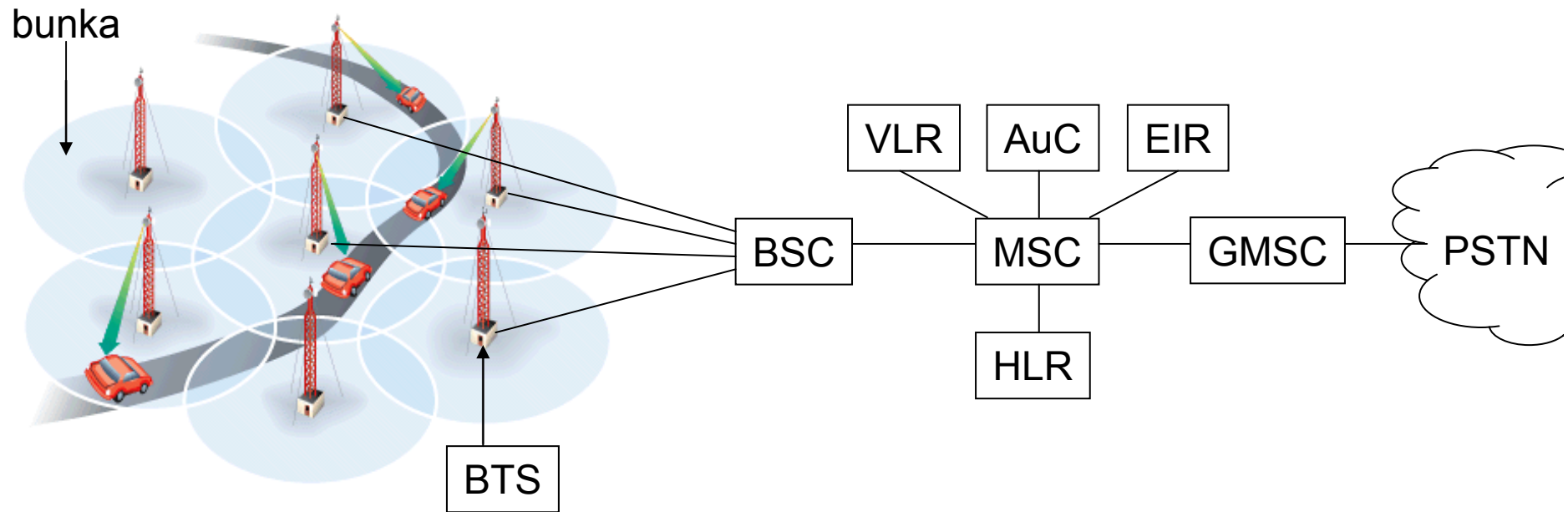
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more

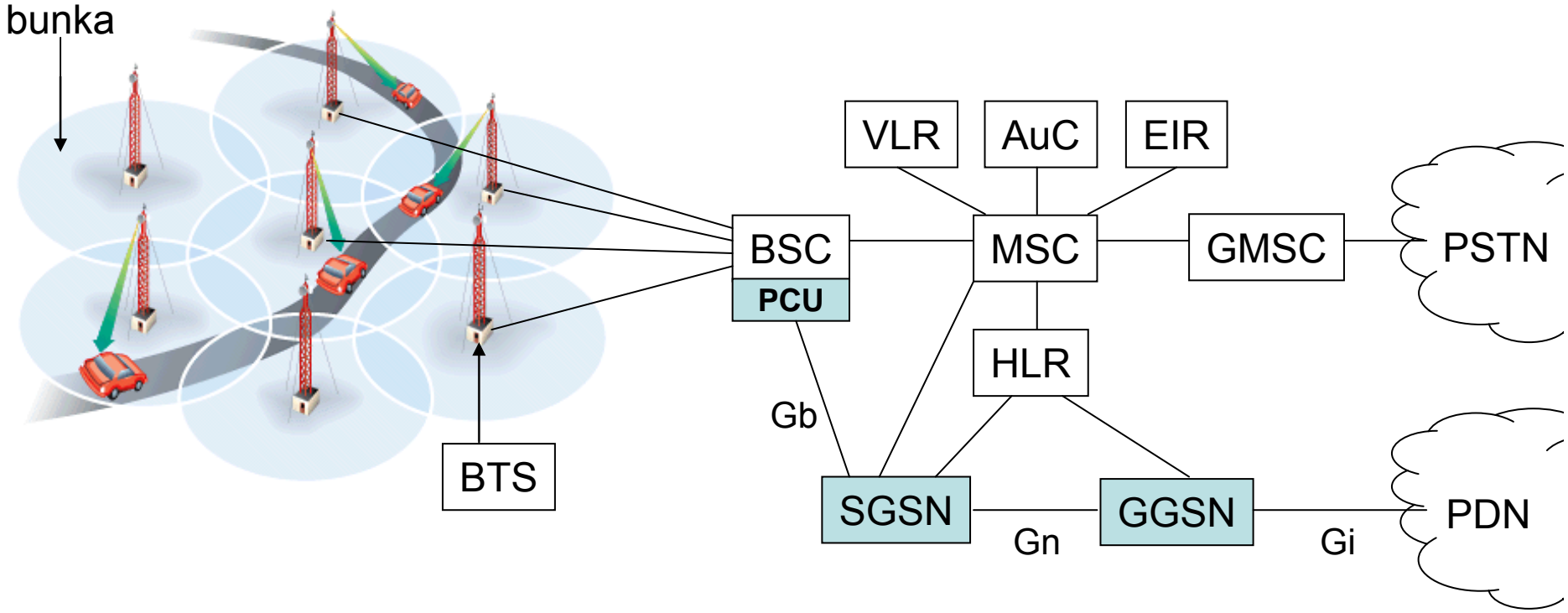
Obsah

- Sieťová architektúra & protokoly
 - GSM, GPRS
- Mobility management
- Vzdušné rozhranie
 - TDMA/FDMA, základné charakteristiky, EDGE
- UMTS ako evolúcia GSM

architektúra GSM

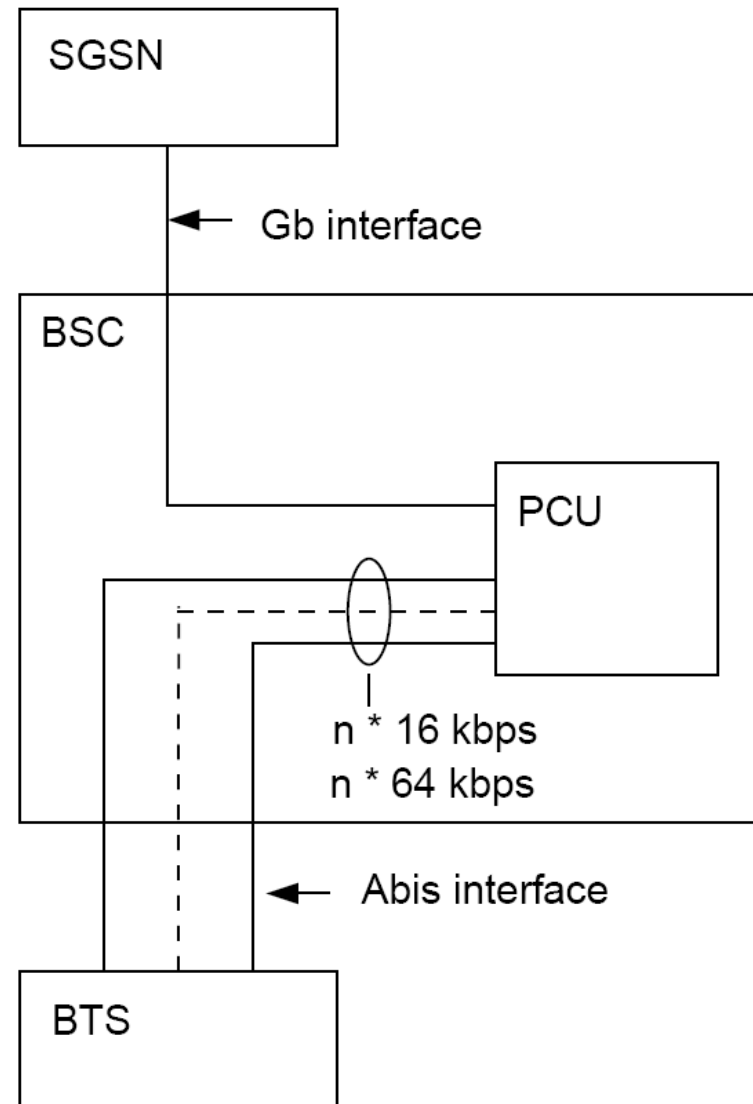


architektúra GSM/GPRS



Packet Control Unit

- Radio resource management
 - MAC, RLC layer
 - BSSGP



Serving GPRS Support Node

Main functions:

- charging
- IP connectivity & routing
- mobility management
- payload handling
- QoS
- security
- session management
- subscriber data management



Gateway GPRS Support Node

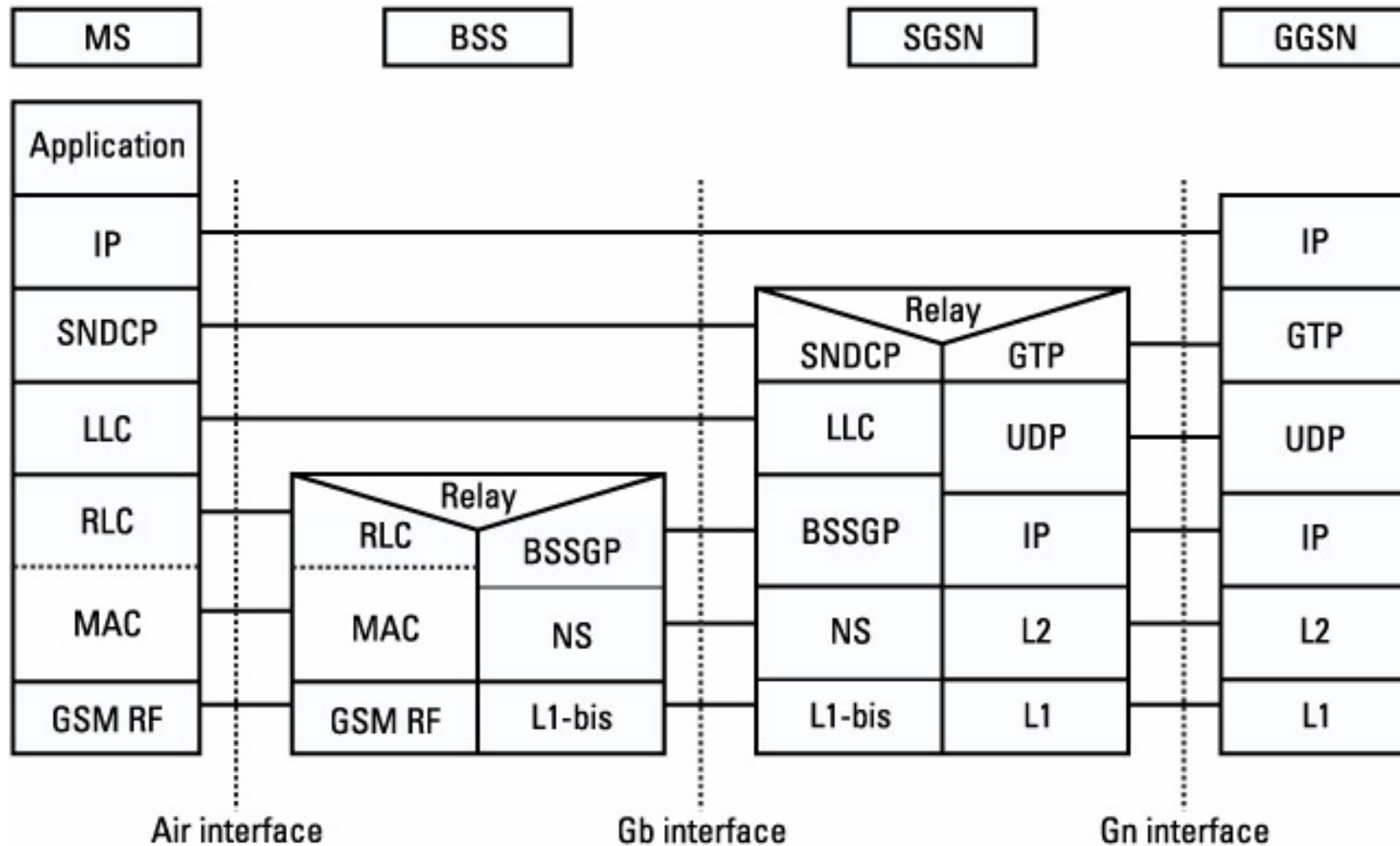
Main functions:

- routing
- tunneling & VPN
- security
- QoS
- charging
- session management



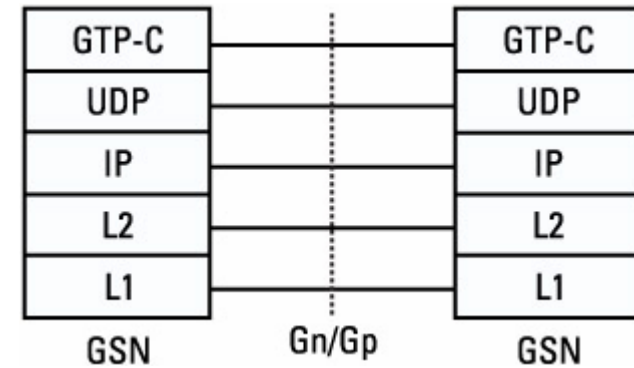
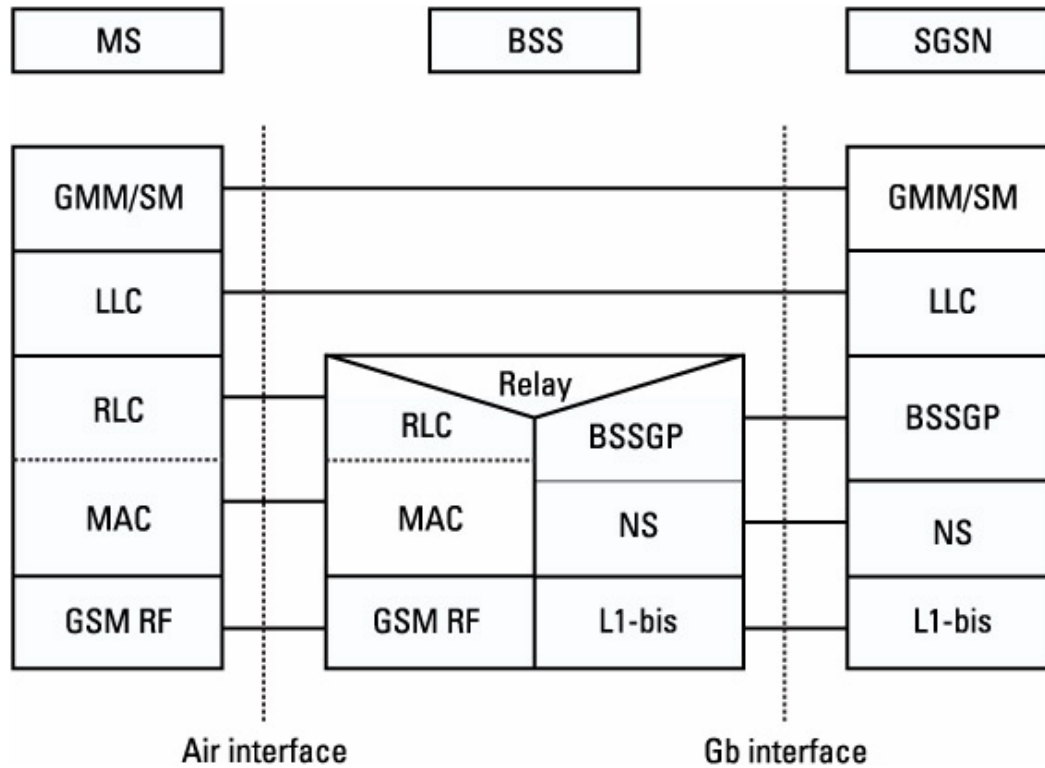
Protokolový model

prenos používateľských dát



Protokolový model

prenos signalizácie



GTP

- used on Gn interface (SGSN-GGSN)
- IP based connection (backbone)
- GTP-U for user data
- GTP-C for control
 - create, update, and delete tunnels
 - path/mobility/location management,
- point-to-point UDP/IP tunnel

SNDCCP

- on Gb interface
- multiplexing of PDPs (NSAPI)
- compression of user data (including IP header compression)
- segmentation/reassembly of data packets to be passed to/from the LLC layer

LLC

- provides a reliable link between the mobile device and the SGSN for both control and user data
- supports variable length information fields from 140 bytes up to a max of 1520 bytes
- acknowledged/unacknowledged mode

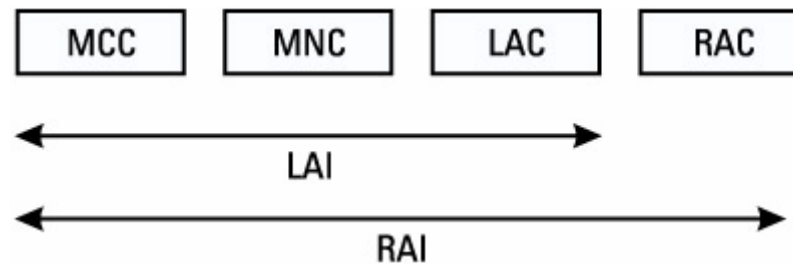
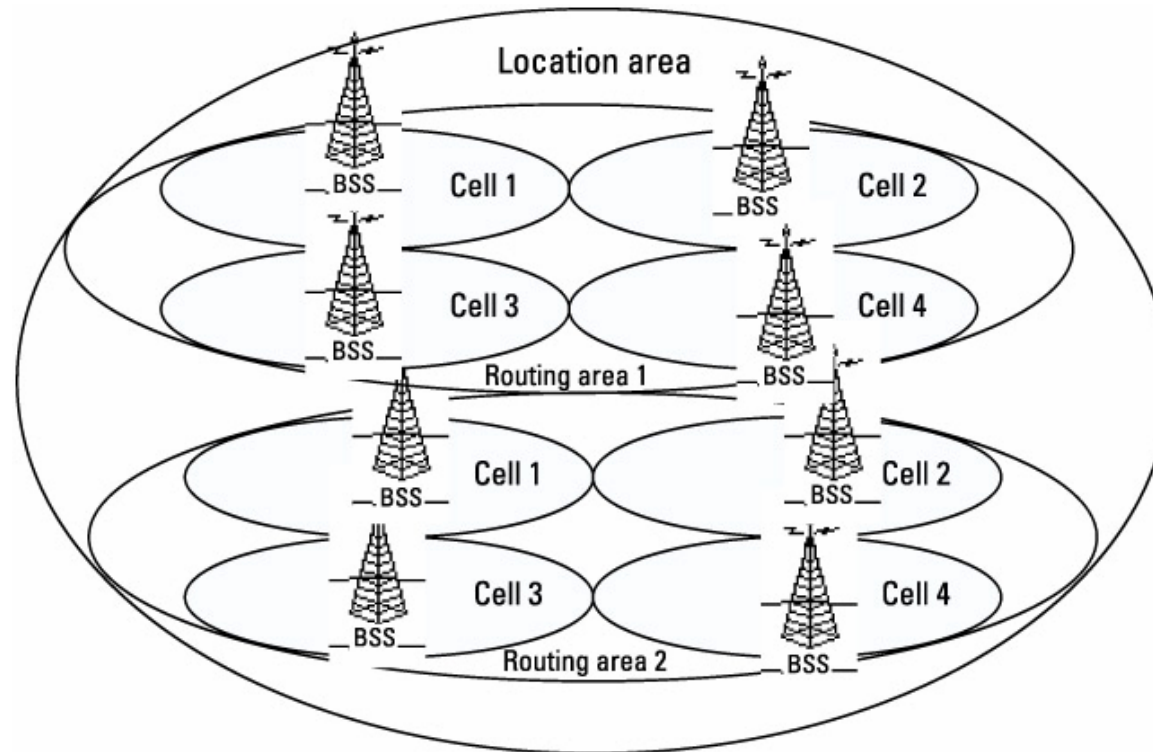
BSSGP

- introduce & provide the required QoS for the user
- routing information between BSS & SGSN
- informs the BSC about the radio capability of the mobile device
- flow control

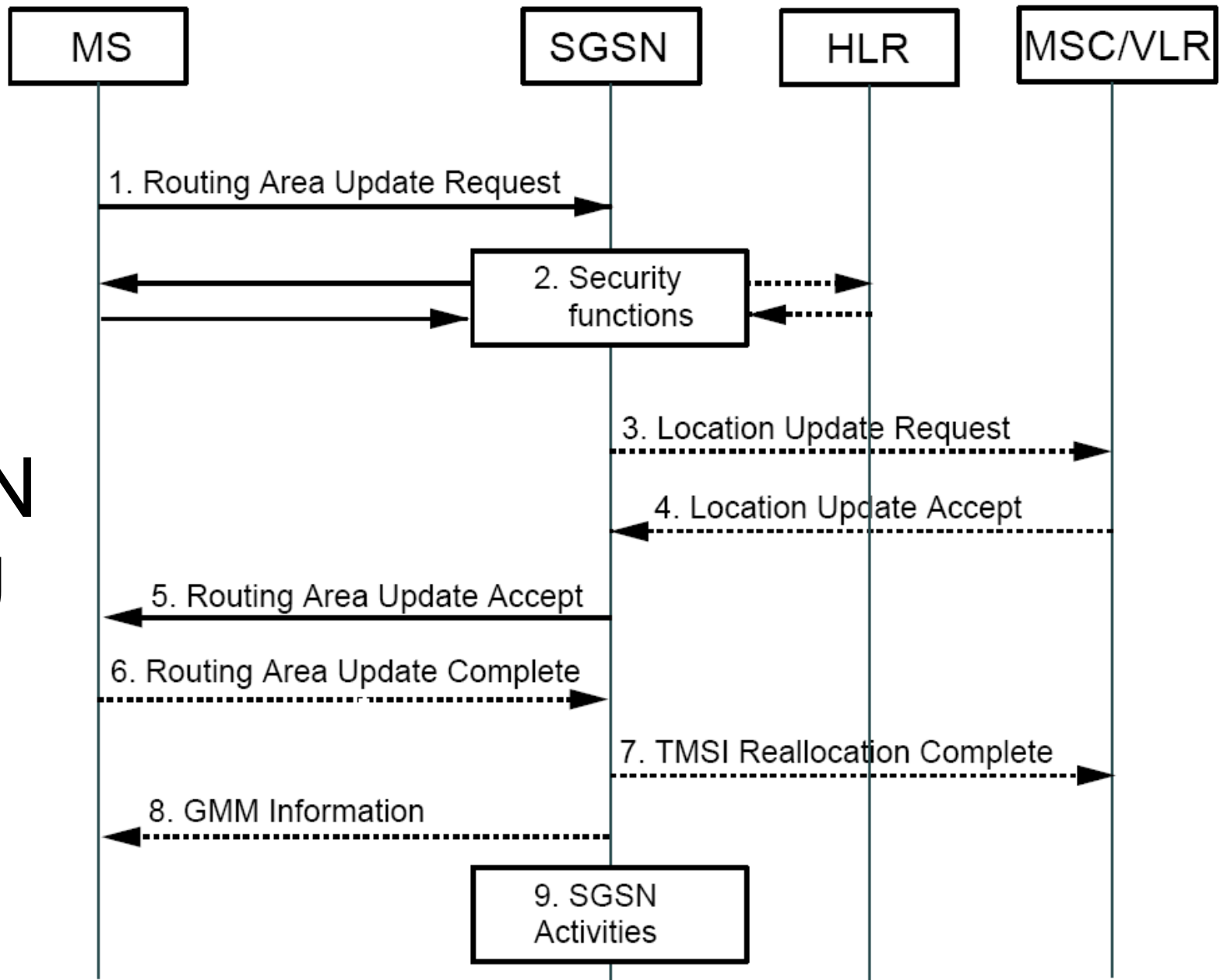
Session/Mobility management

- Routing area concept
- Session management – PDP context
- Mobility states
 - attach/detach procedure

Routing area

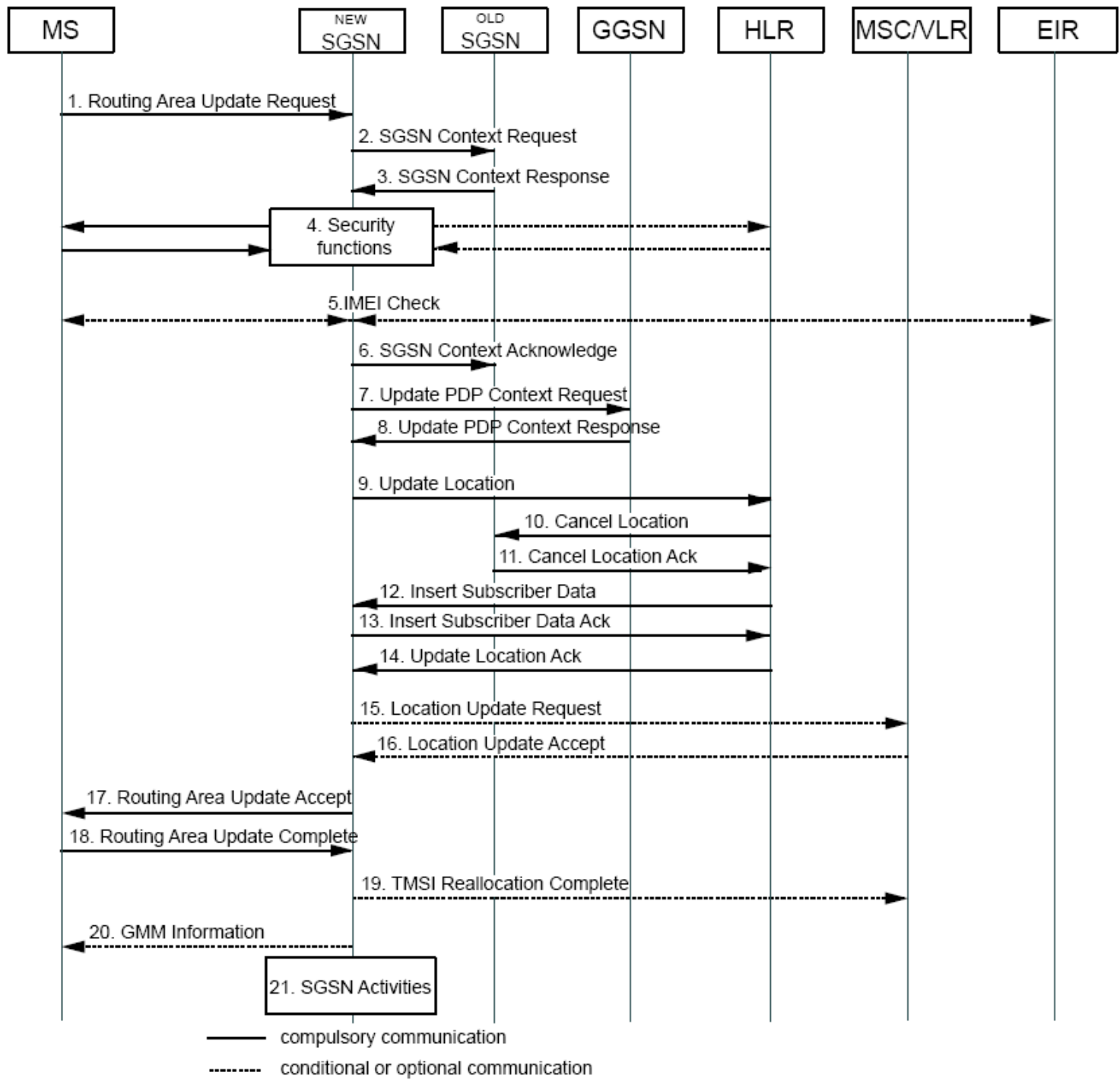


Intra SGSN RAU

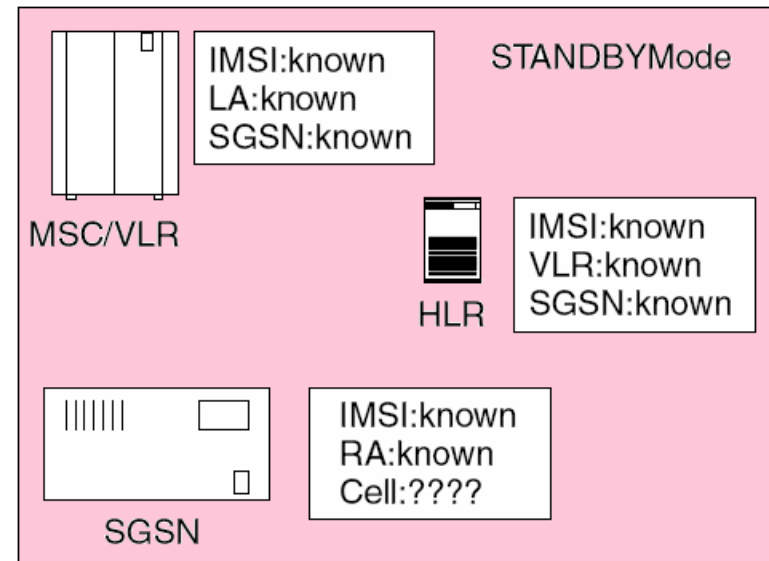
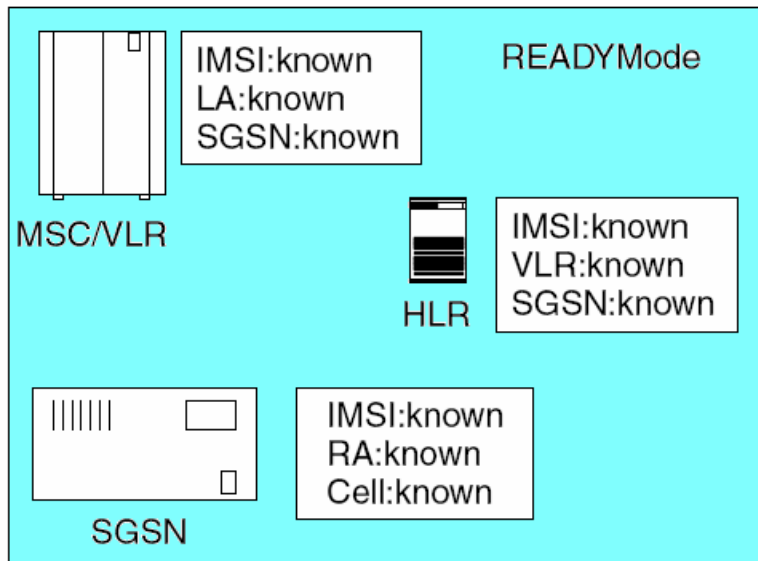
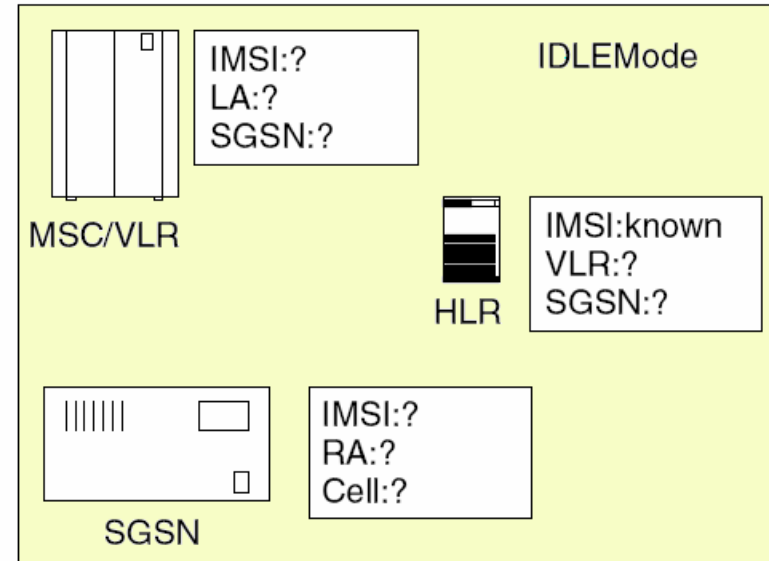
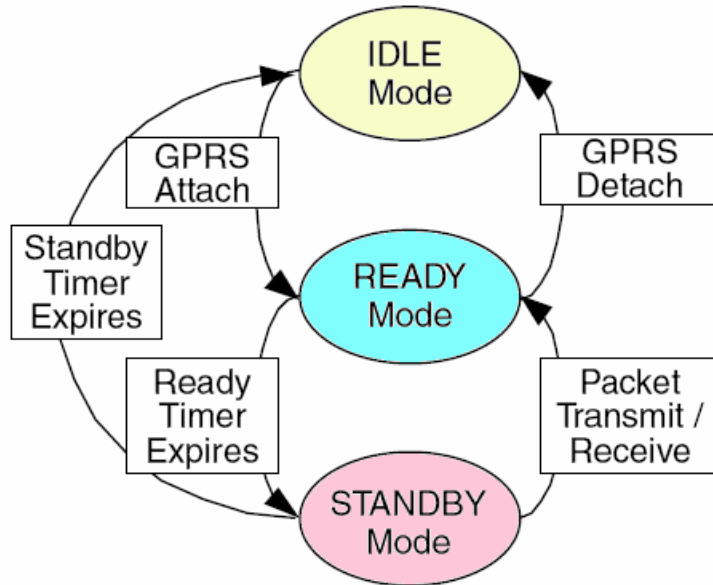


— compulsory communication
..... conditional or optional communication

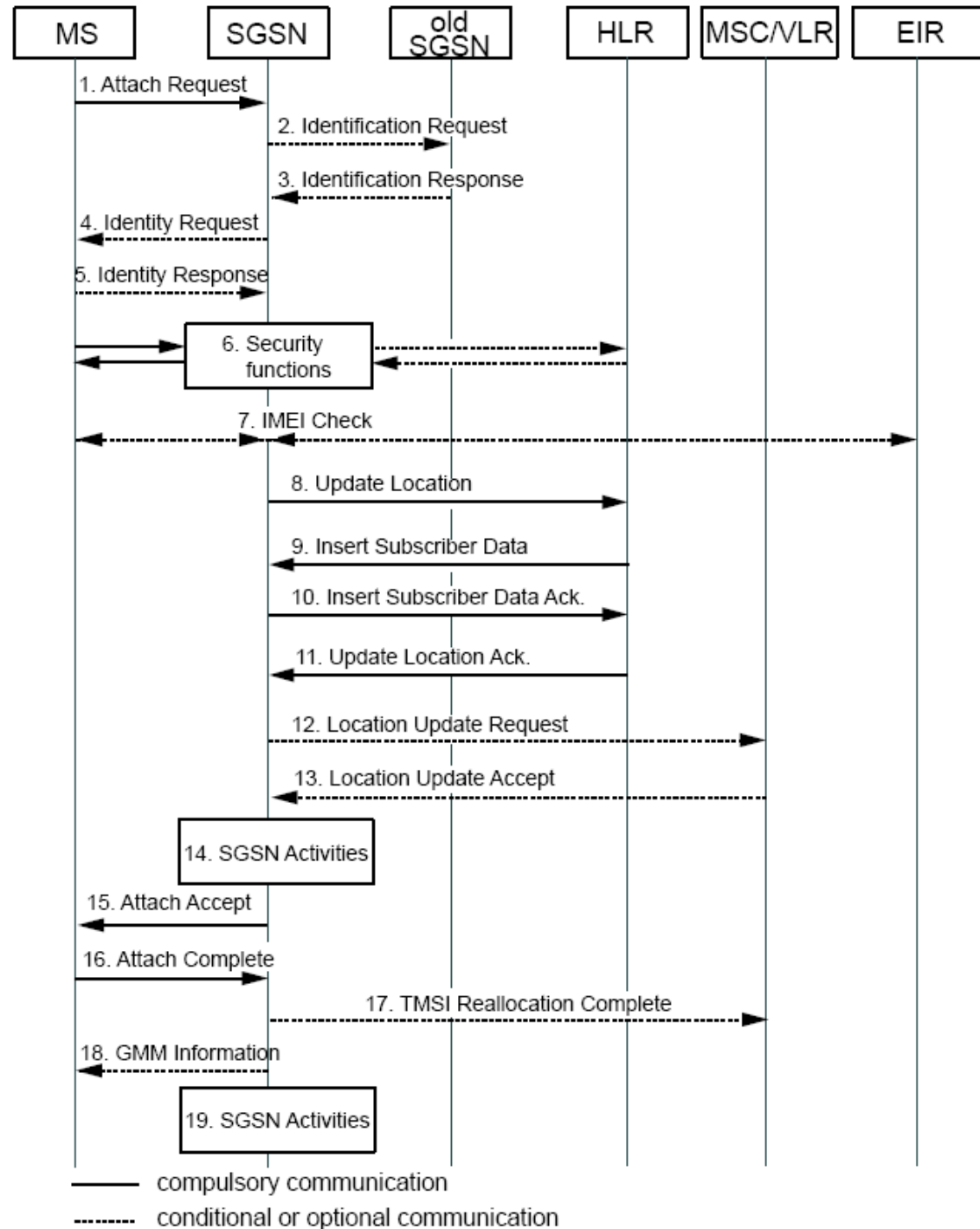
Inter SGSN RAU



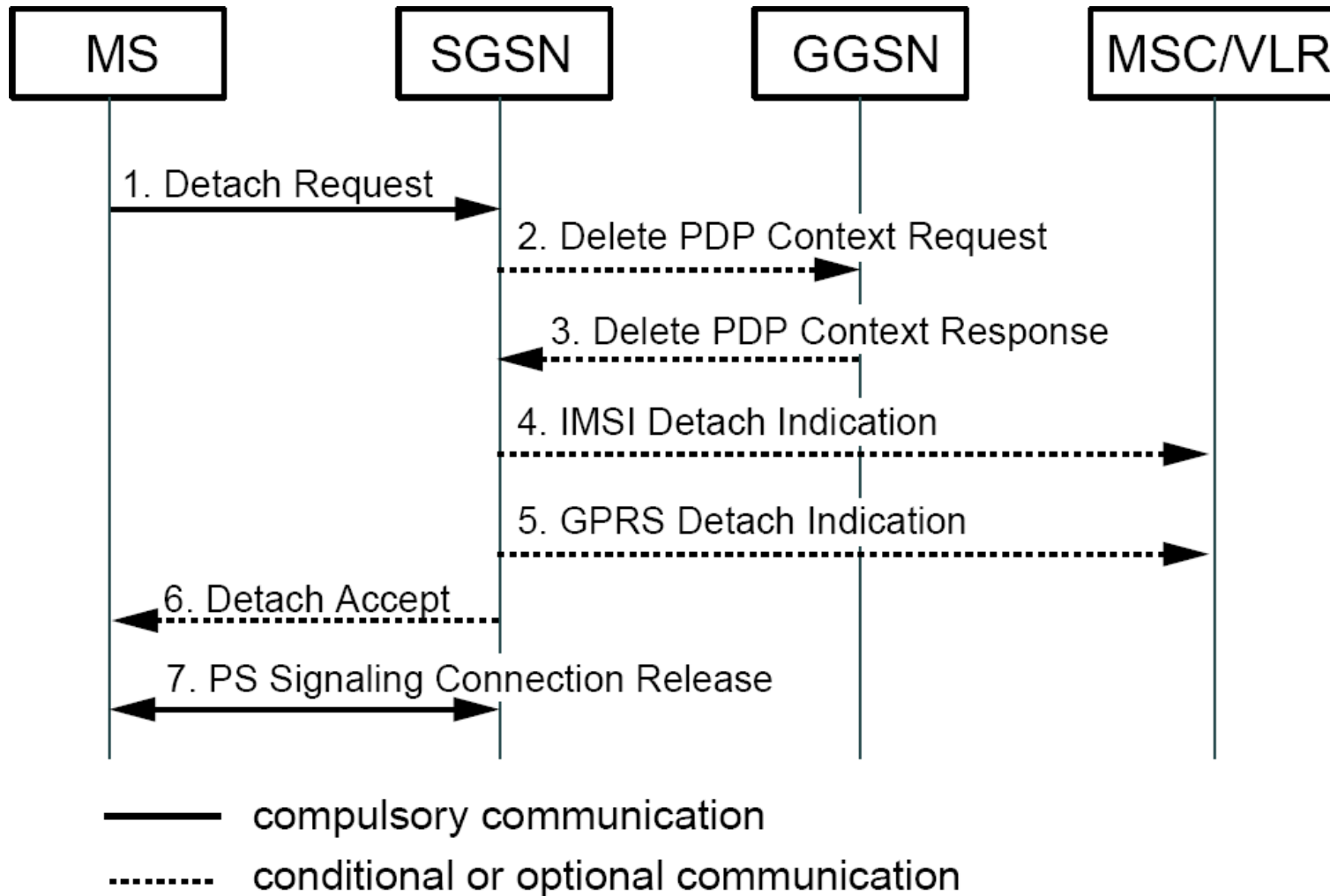
Mobility states



GPRS attach procedure

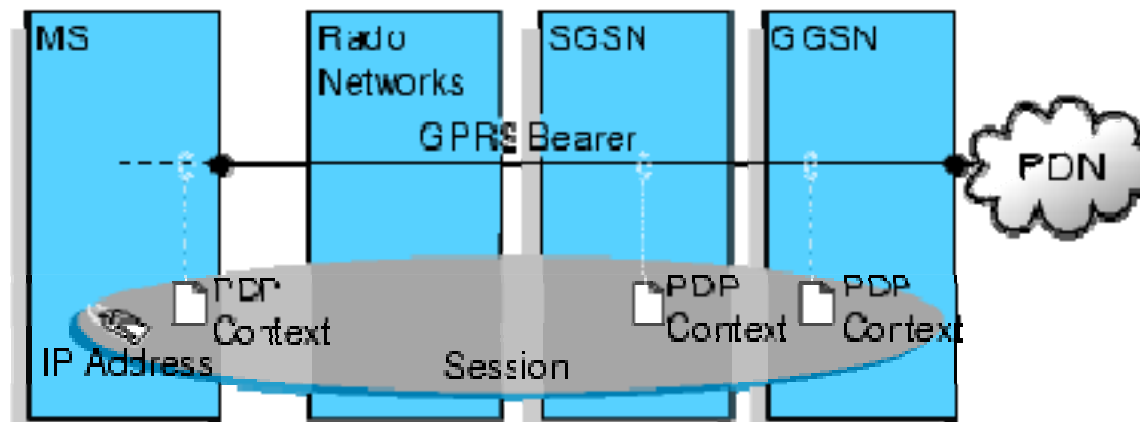


GPRS detach procedure

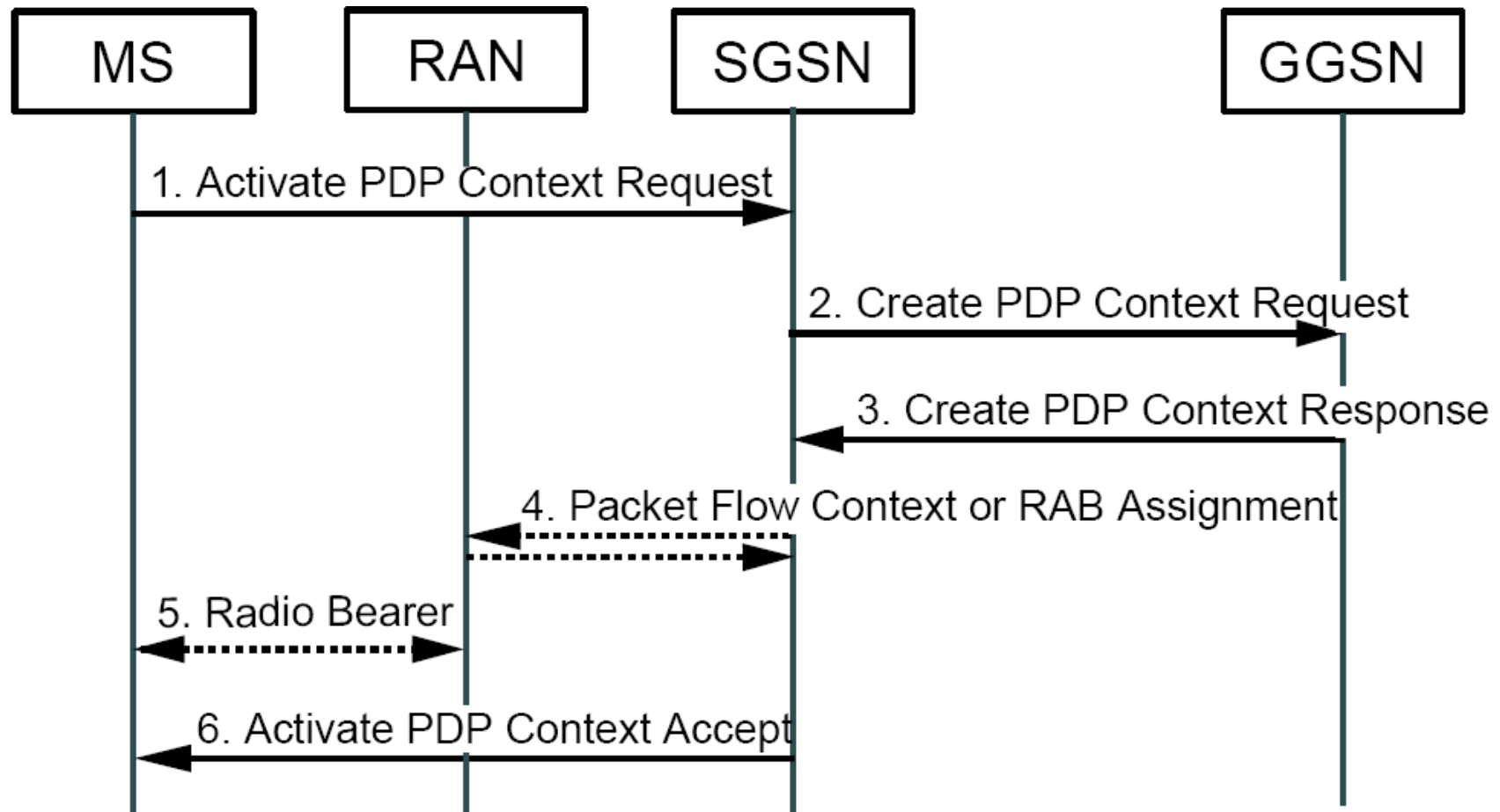


PDP context

- Packet Data Protocol Type (e.g. IPv4)
- PDP address (IP address)
- QoS
- address of GGSN (or APN)



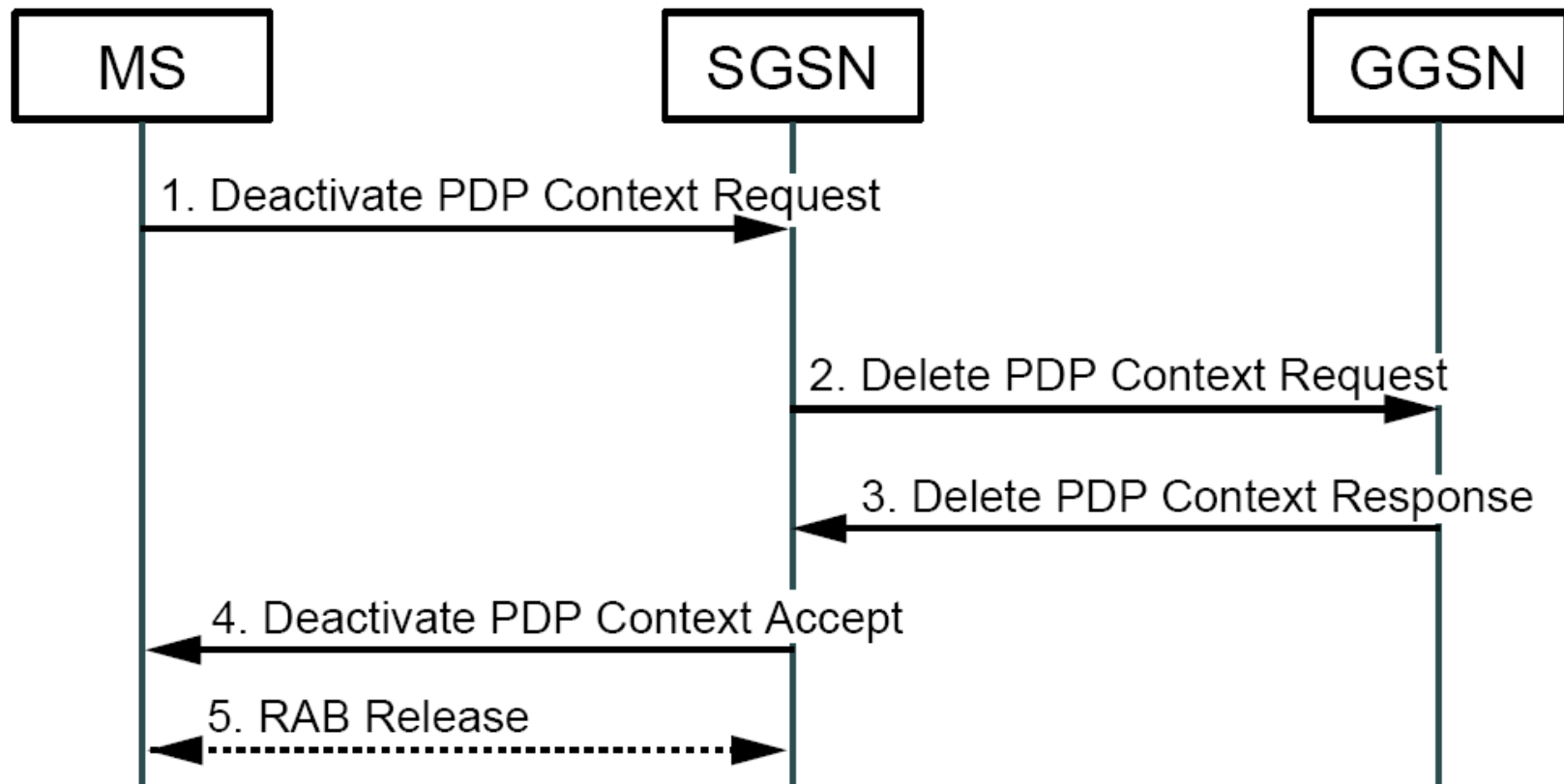
PDP Context Activation Procedure



———— compulsory communication

..... conditional or optional communication

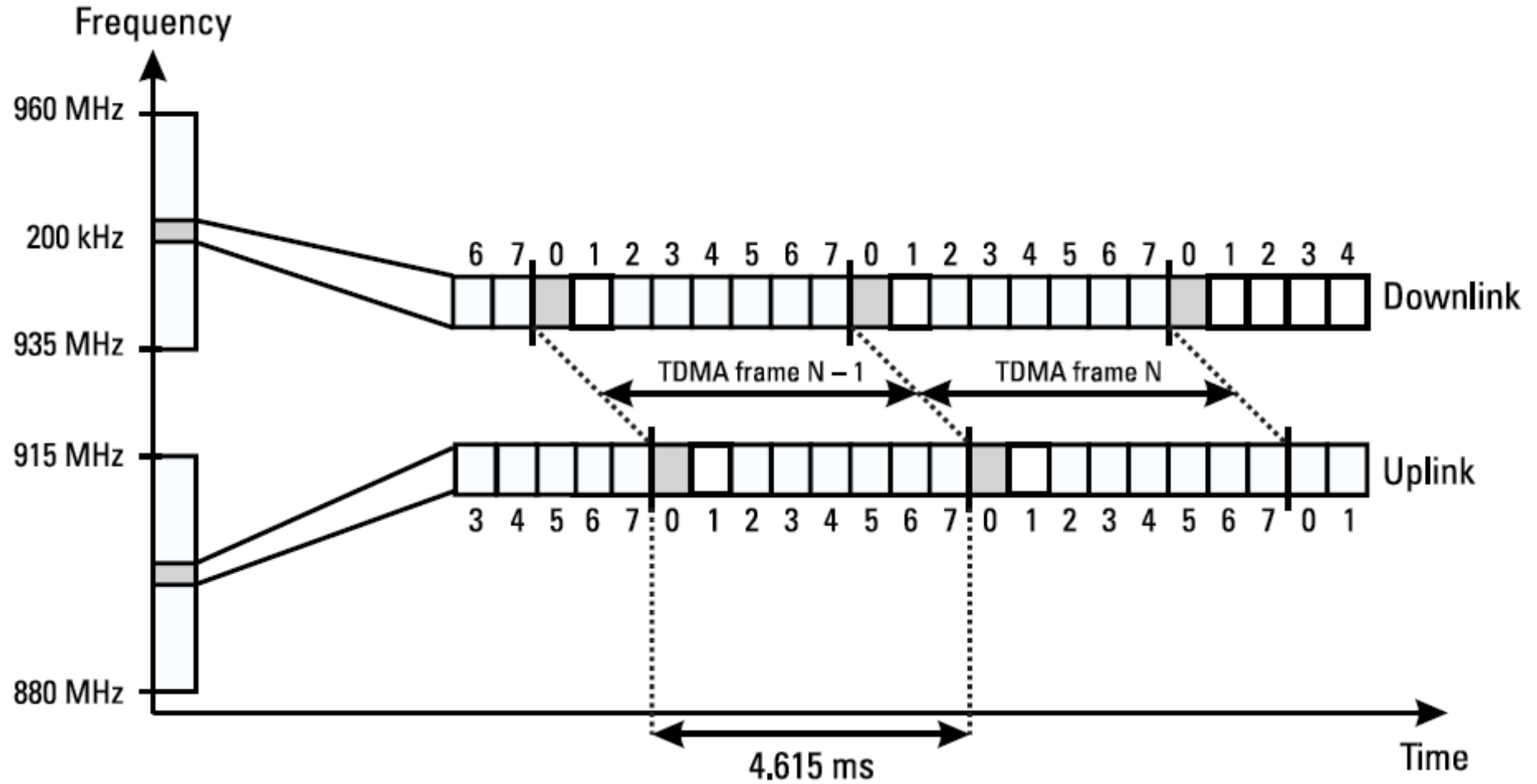
MS-Initiated PDP Context Deactivation Procedure



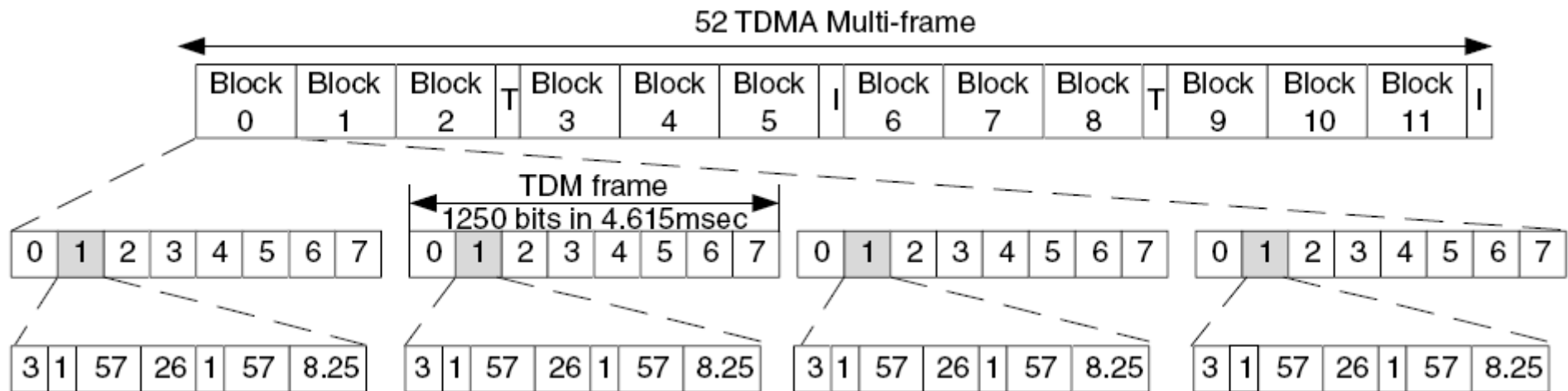
———— compulsory communication

..... conditional or optional communication

GSM air interface

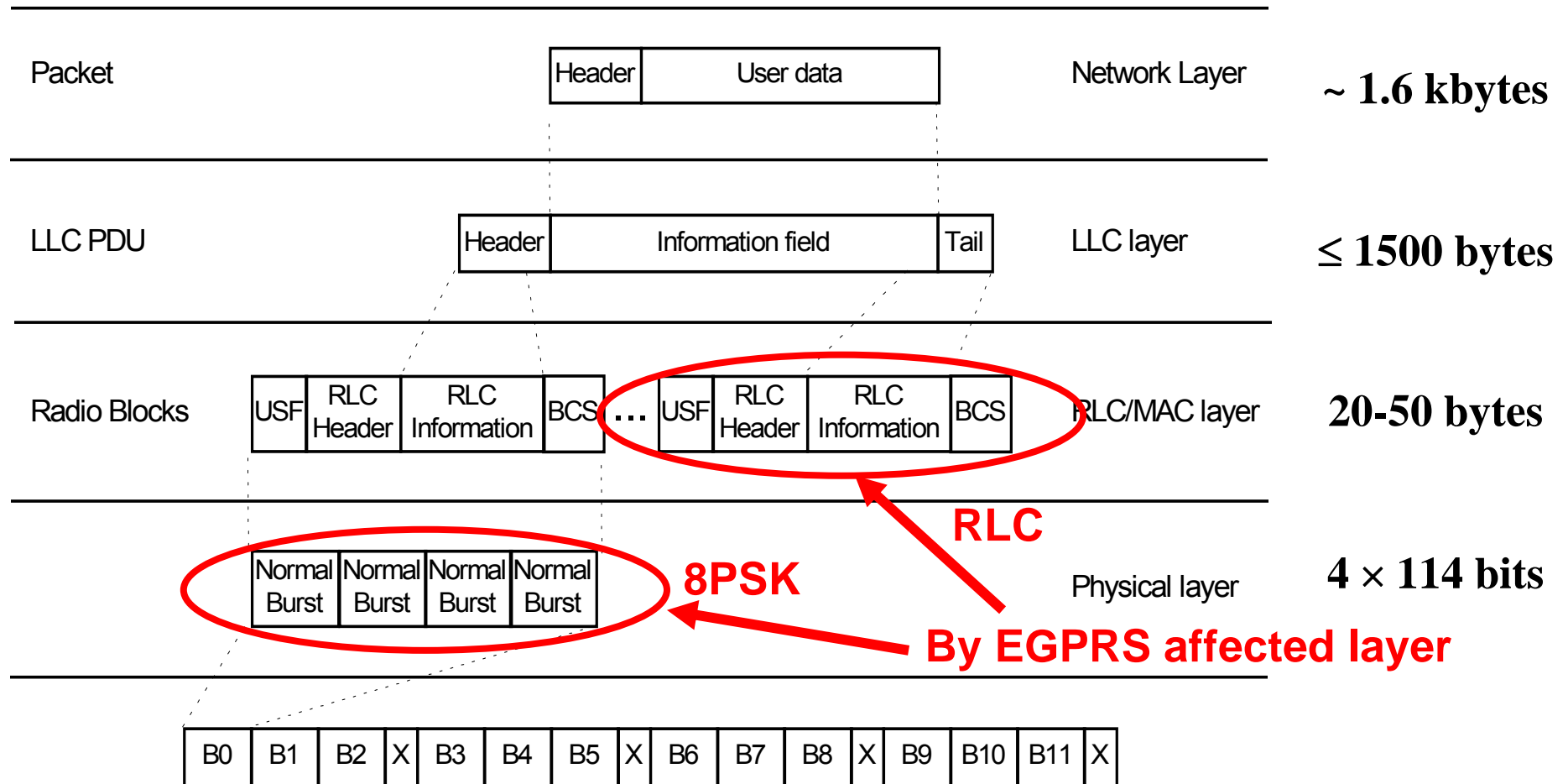


GPRS air interface



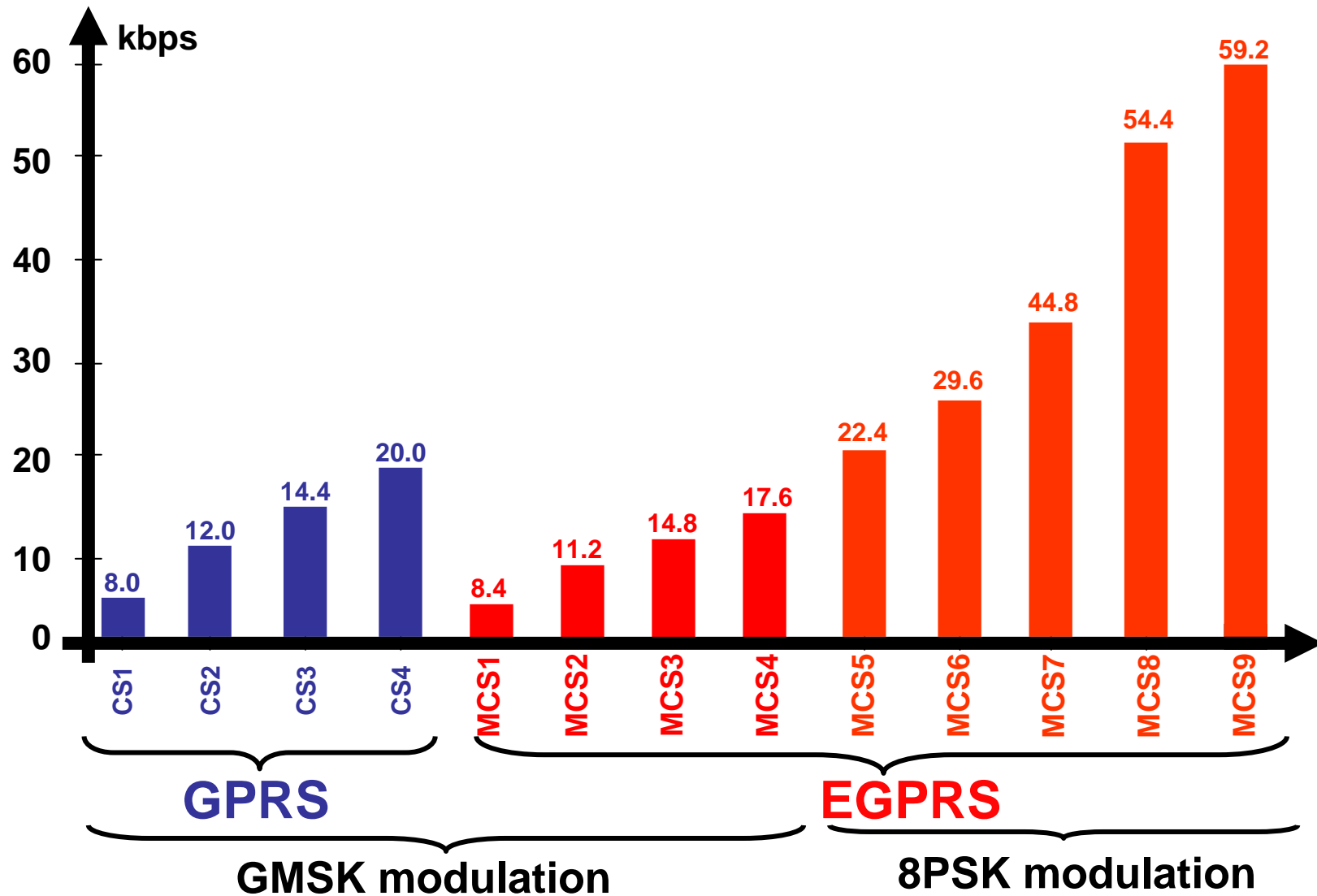
Coding scheme	Pre-cod. USF	Infobits without USF	Parity bits BC	Tail bits	Output conv encoder	Punctured bits	Code rate	Data rate kbits/s
CS-1	3	181	40	4	456	0	1/2	9.05
CS-2	6	268	16	4	588	132	~2/3	13.4
CS-3	6	312	16	4	676	220	~3/4	15.6
CS-4	12	428	16	-	456	-	1	21.4

Multiframe structure



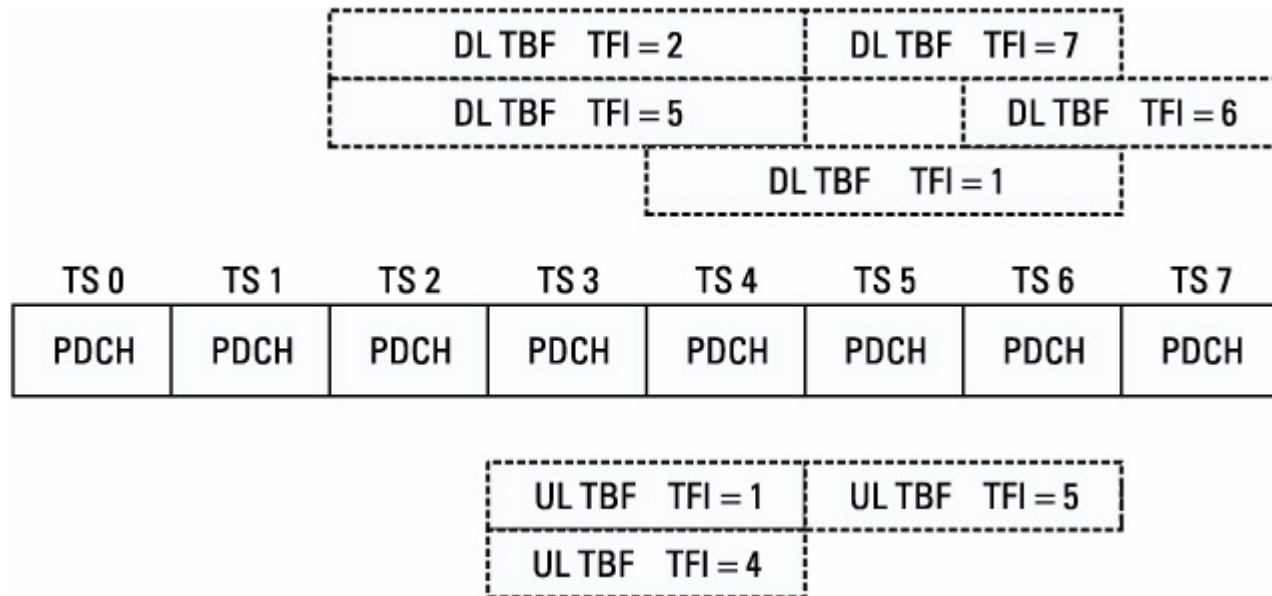
Multiframe structure, 52 TDMA frames

EDGE - EGPRS

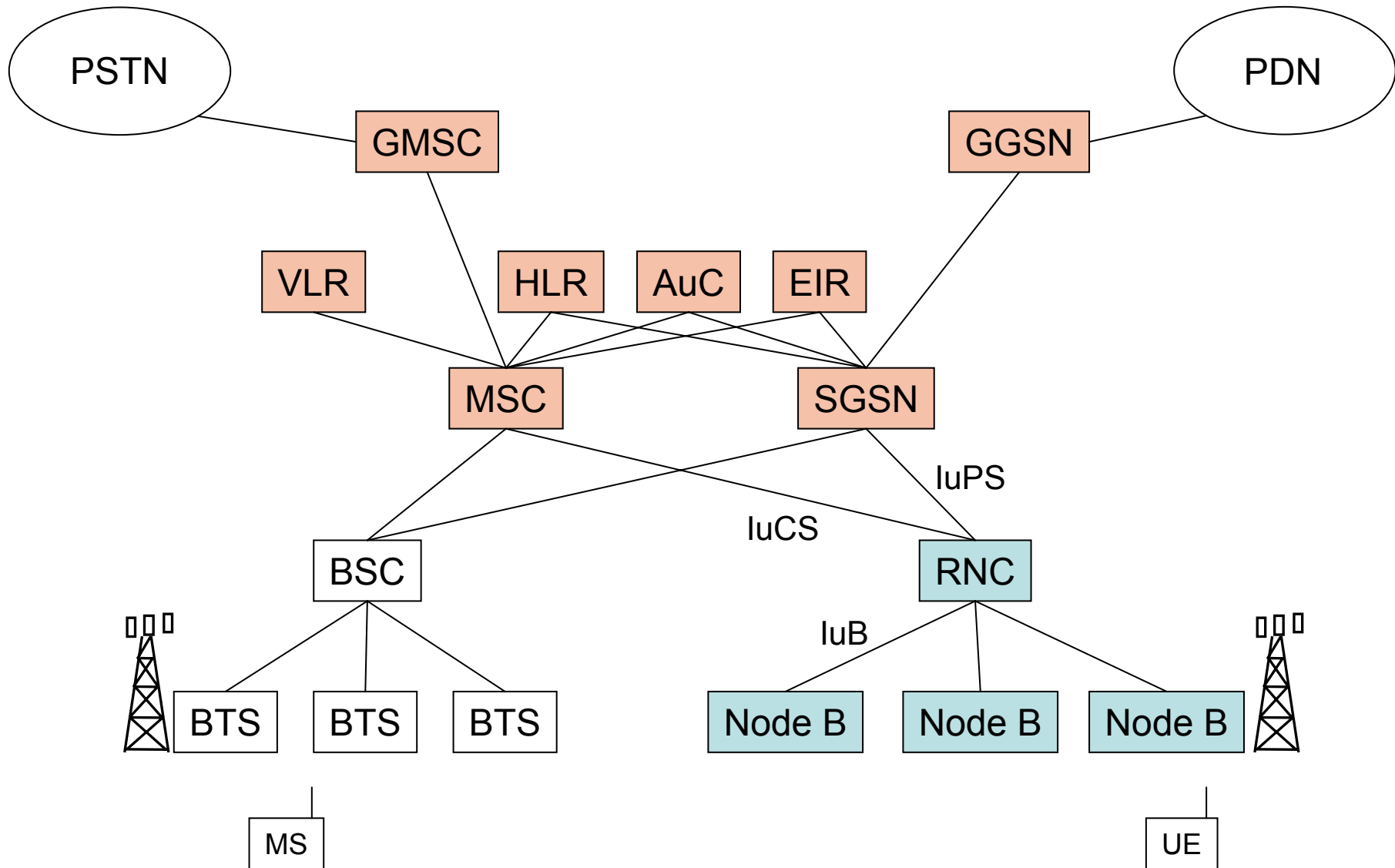


Temporary Block Flow

- The transmission of packets to/from a certain MS is called a TBF
- TFI used for DL multiplexing
- USF used for UL multiplexing



UMTS architecture



Basic facts

- new radio access technology
 - CDMA, 5 MHz FDD, ...
- smooth evolution of core network
- new protocol stacks for new interfaces
- some changes in mobility management

Basic principles – code separation

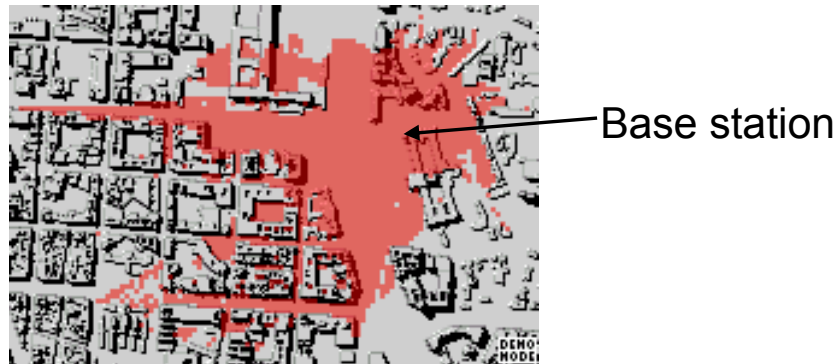
- UMTS uses codes for user separation – users share time and frequency resources



New effects in UMTS Access Network

Cell breathing

- The more users are active in a cell, the smaller the cell radius



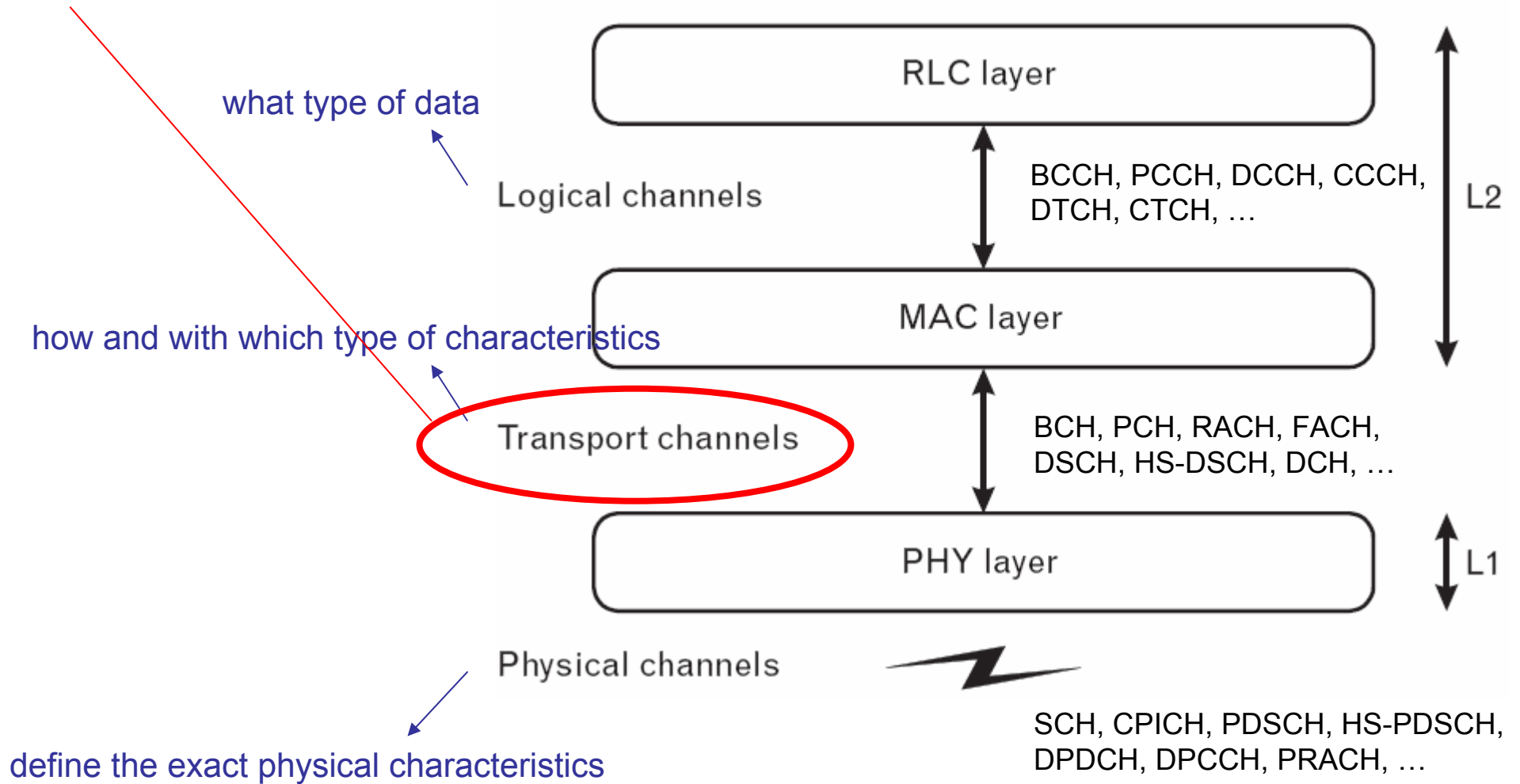
- Interference limited system => capacity depends on available RBS power (\uparrow) & user activity (\downarrow)

Air interface

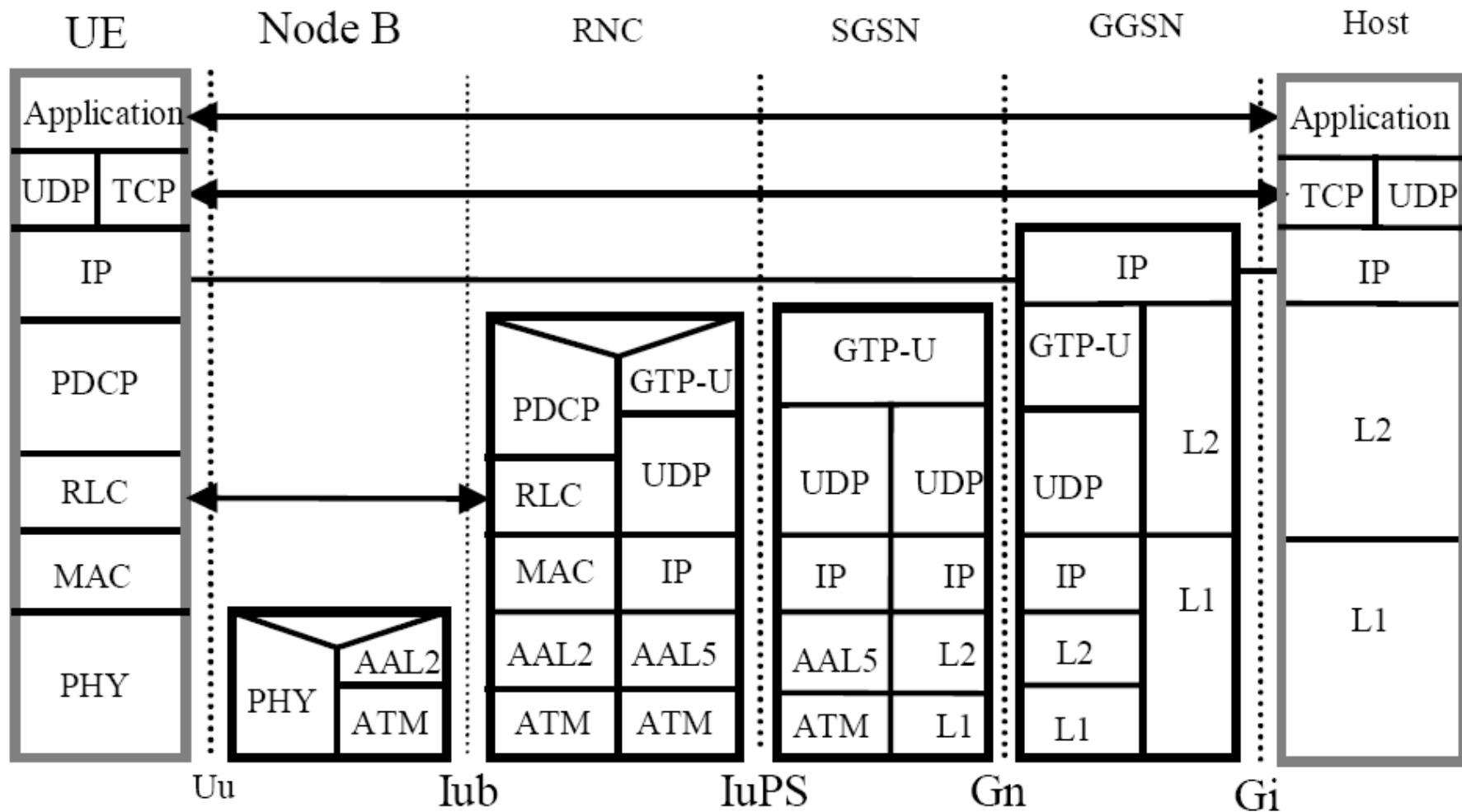
- FDD or TDD, 5 MHz channel
- 3,84 Mchip/s, QPSK
- Phy bitrates: up to 1920 kbps DL, 960 kbps UL

Channel concept

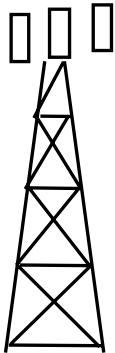
new for UMTS, not in GSM/GPRS



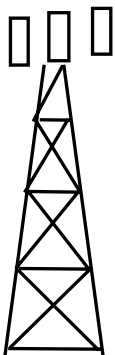
UMTS UP protocol model



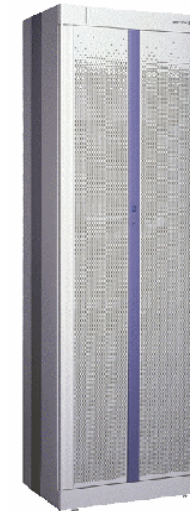
Protocol model for IuB



RN CP		TN CP	PS UP	B CP	CS Data UP	CS Voice
NAS			Application		Application	AMR
RRC	NBAP	ALCAP	PDCP	BMC	TAF	
RLC		STC	RLC			
MAC	SSCF-UNI	SSCF-UNI	MAC			
FP	SSCOP	SSCOP	FP			
AAL2	AAL5	AAL5	AAL2			
ATM						



RN CP		TN CP	PS UP	B CP	CS Data UP	CS Voice
NAS			Application		Application	AMR
RRC	NBAP	ALCAP	PDCP	BMC	TAF	
RLC		STC	RLC			
MAC	SSCF-UNI	SSCF-UNI	MAC			
FP	SSCOP	SSCOP	FP			
UDP	SCTP	SCTP	UDP			
IPv4 / IPv6						
Ethernet						



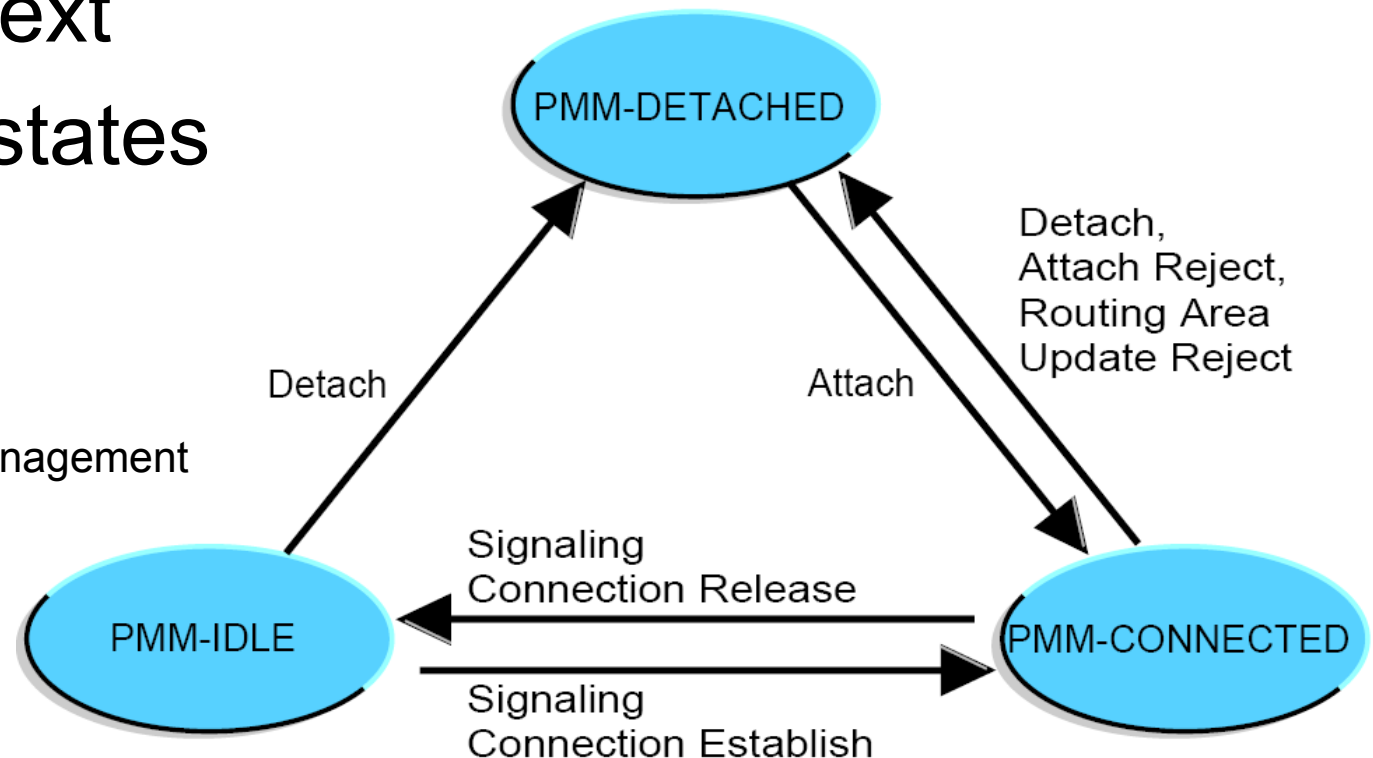
RNC

Node B

Session/Mobility management

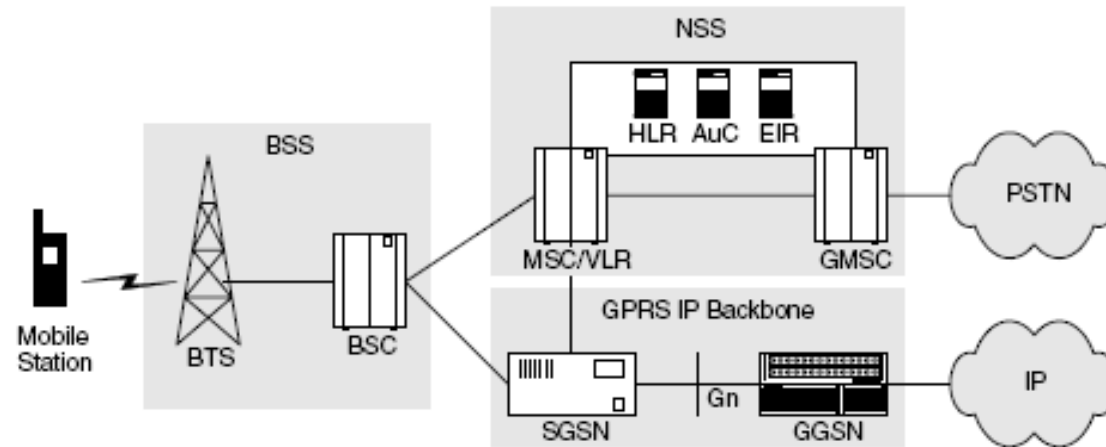
- basically the same as for GPRS
- the same Routing Area concept
- PDP context
- new MM states

PMM = Packet Mobility Management

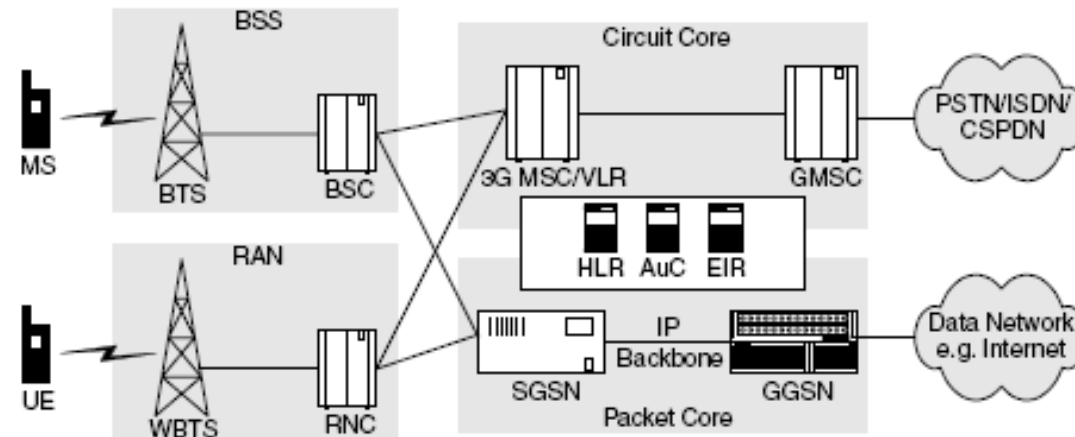


Core network evolution I

GSM/GPRS

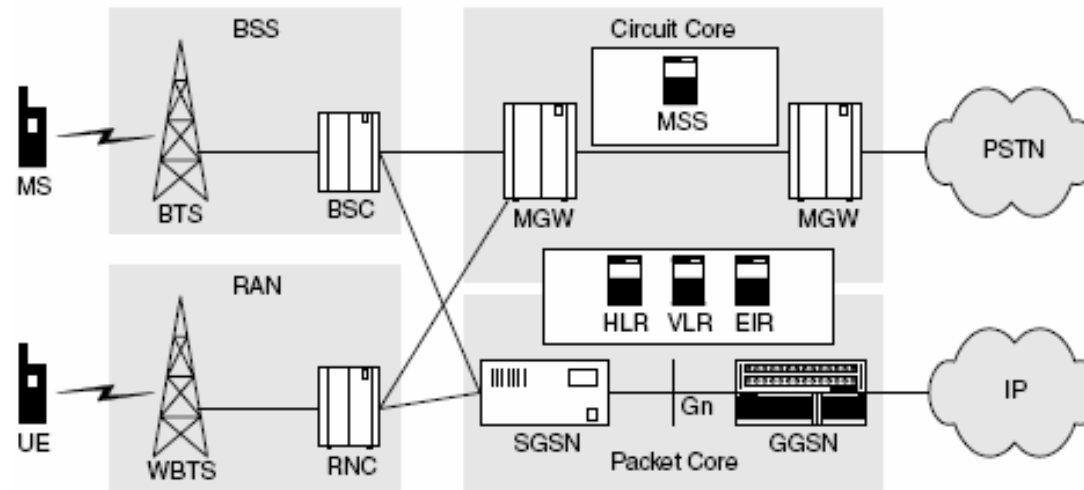


UMTS R99

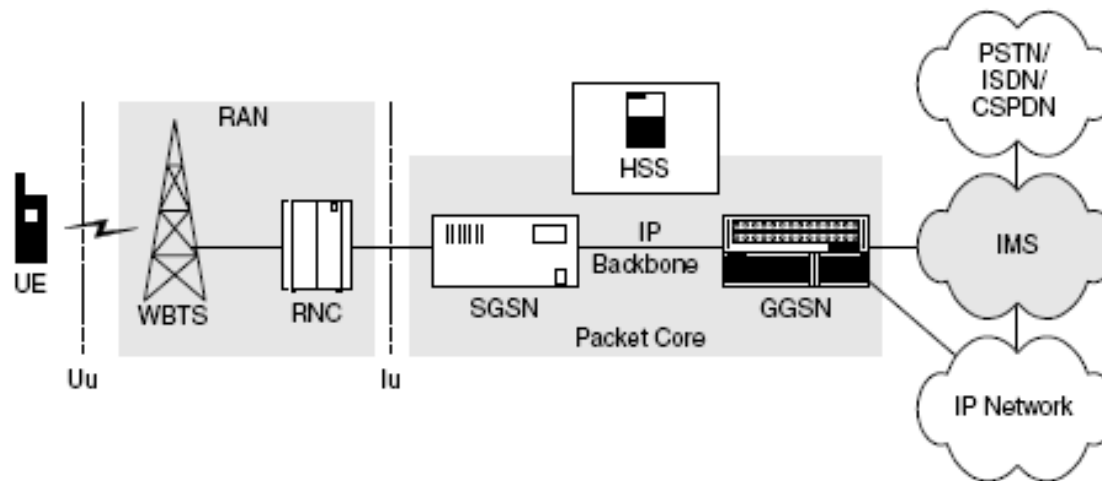


Core network evolution III

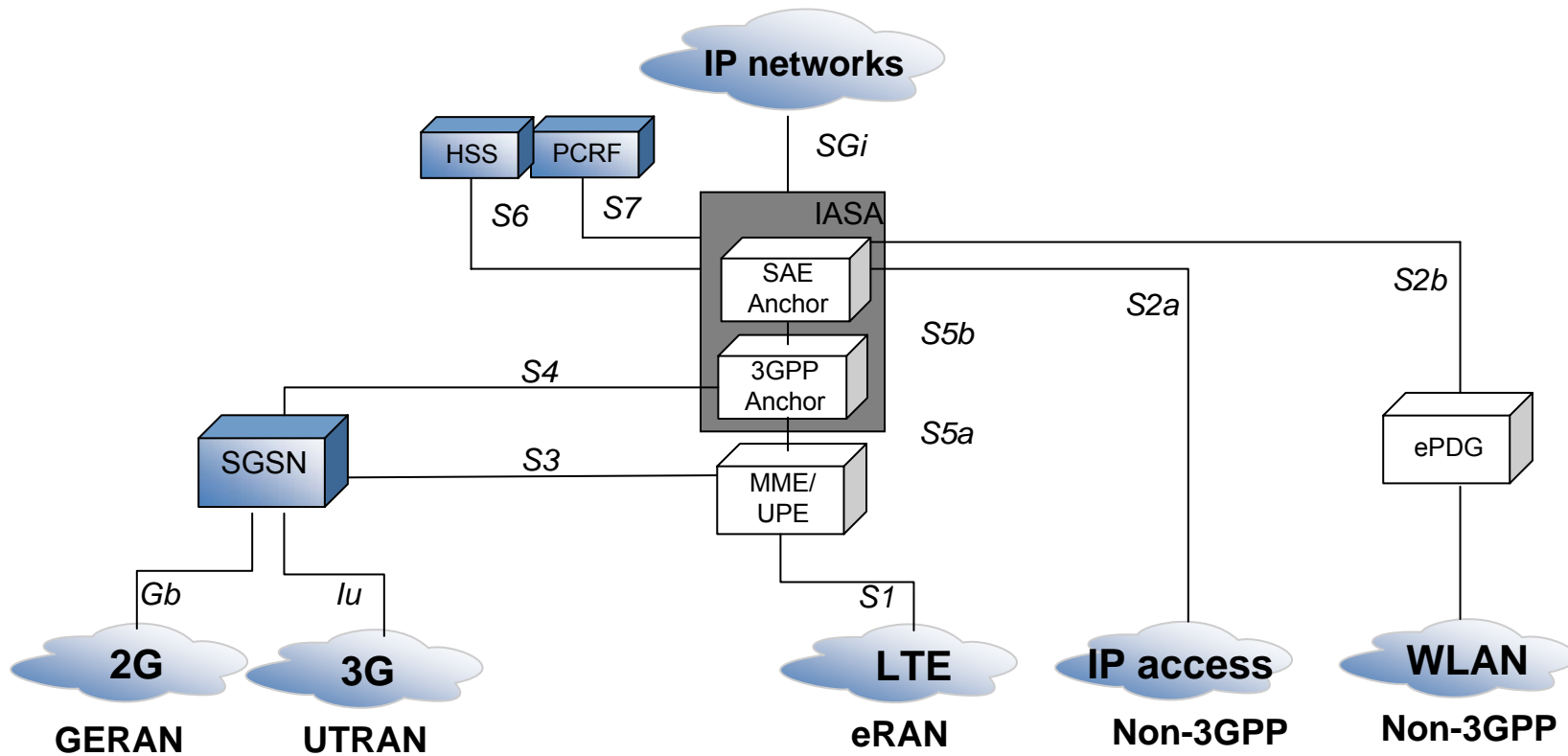
UMTS R4



UMTS R5



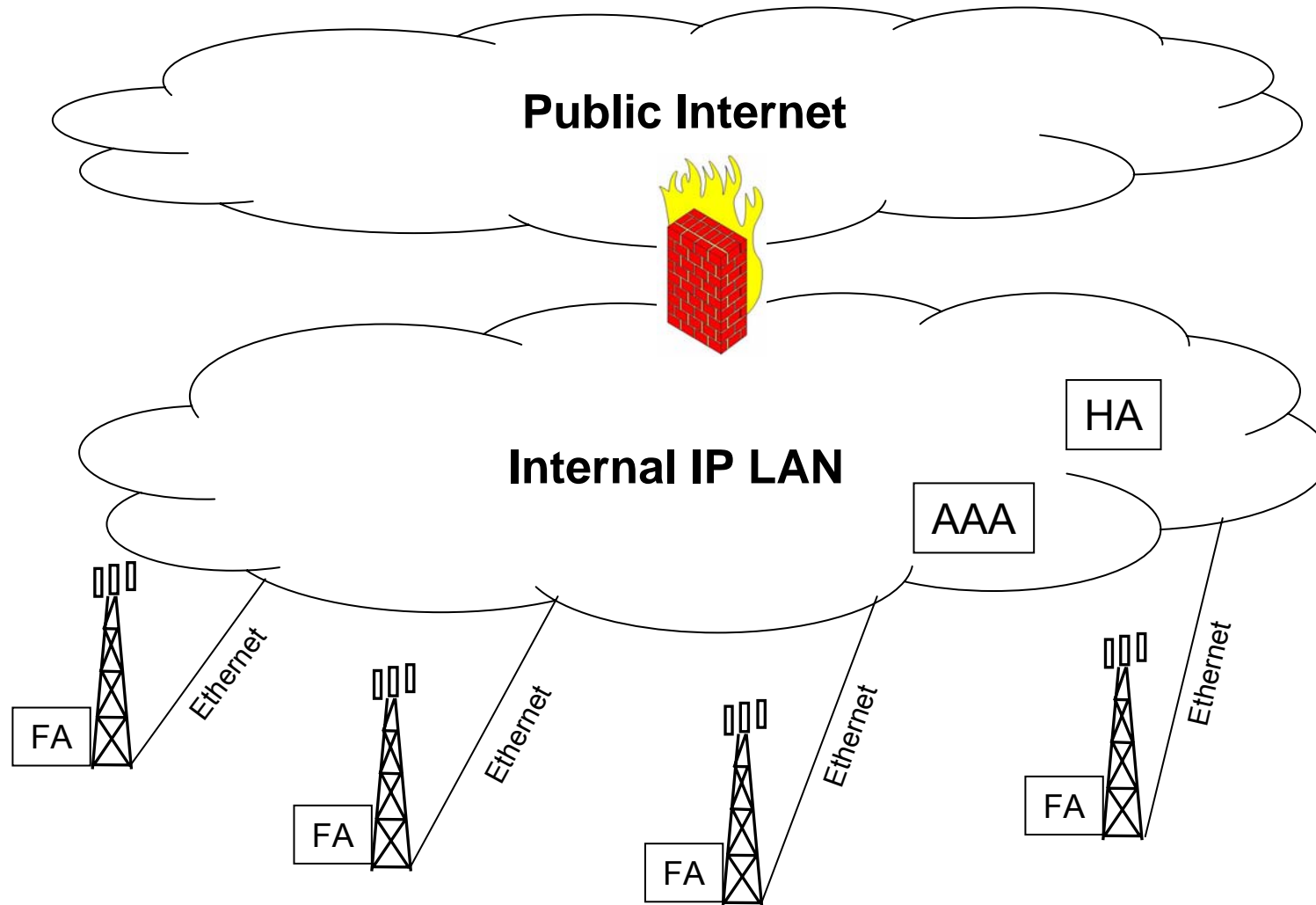
UMTS System Architecture Evolution



UMTS – the right model for data?

- NO!
 - hierarchical
 - centralized
 - protocol translations
 - QoS models differ from IP world
- Solution:
 - connect every base station directly to Internet
 - use Mobile IP protocol

Flat all IP architecture



All IP – a comparison

- UMTS all IP vs. F-OFDM all IP

