



GPRS

General Packet Radio Service

EDGE

Enhanced Data for GSM Evolution

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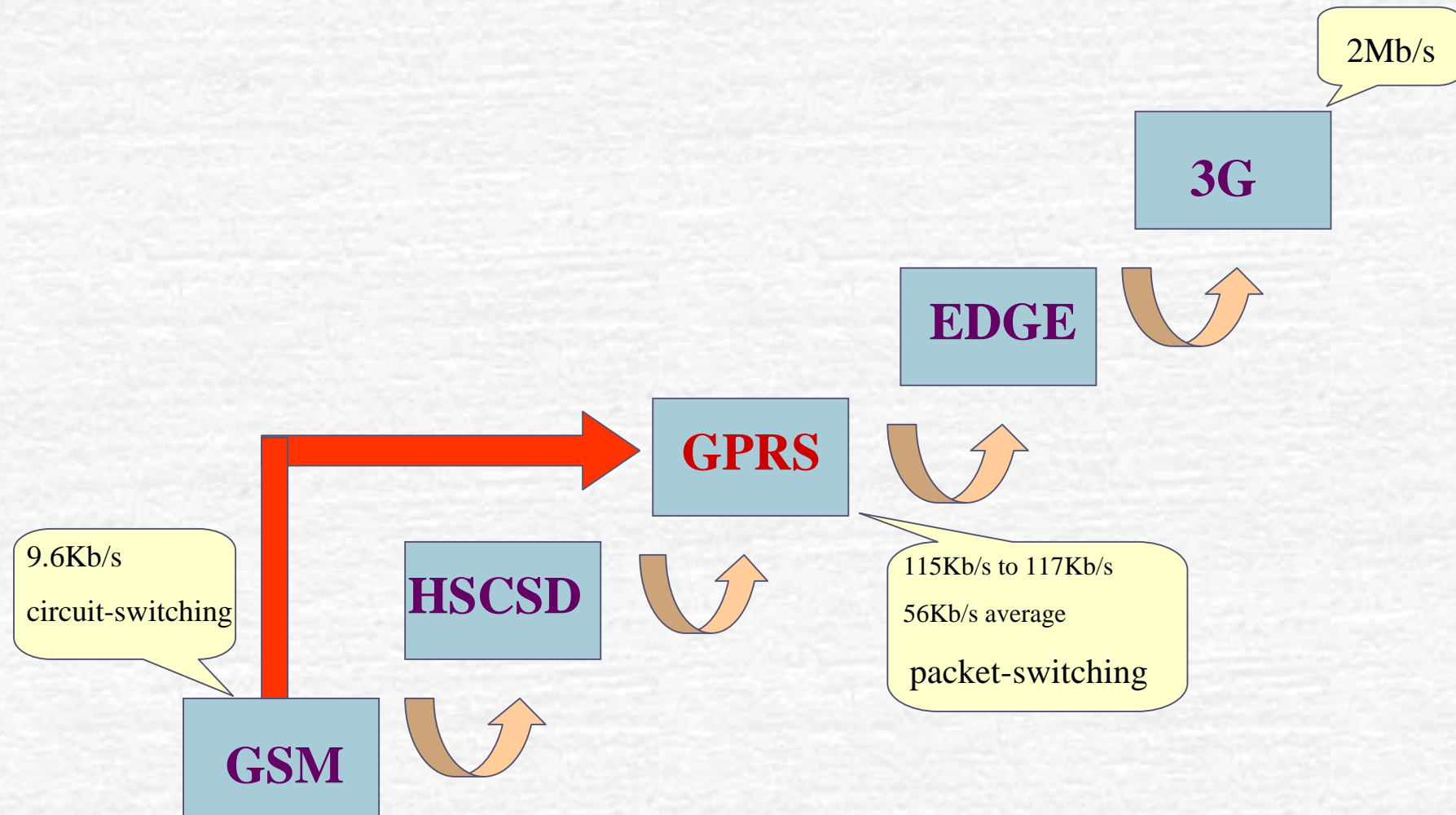
GPRS

- Introduction
- Part 1 GPRS Features
 - Key users features
 - Key Network features
- Part 2 General Architecture
 - Entity and Interfaces
 - Layer Architecture
 - Network Protocols
- Part 3 Roaming
 - GPRS Mobiles
 - State of mobile
 - Temporary Identities
 - Attach/Detach
- Part 4 Session
 - PDP Context
 - Activation of PDP
- Part 5 GPRS Radio
 - Packet Logical Channel
 - Coding Scheme
- Part 6 Applications of GPRS
- Conclusion

Introduction

- GPRS: General Packet Radio Service
- Packet-based data bearer service for wireless communication .
- GPRS supports the world 's leading packet-based Internet communication protocols, IP and X.25
- It is based on GSM communication and will complement existing services such as circuit-switched cellular phone connections and the sms.
- The first important step on the path to 3G.

GSM to 3G



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PART 1: GPRS FEATURES

- Key users features of GPRS:
 - Speed
 - Theoretical max speed is 171.2 kbps using all 8 time slots at the same time.
 - GPRS data speeds are likely to average about 56kbps.
 - Immediacy
 - No dial up modem connection is necessary.
 - GPRS users are » always connected »
 - New applications, Better applications
 - the higher data rates will allow users to take part in videoconferences and interact with multimedia websites

• Key Network features of GPRS

- Packet Switching

- the information is split into separate packets and then reassembled at the receiving end.

- Spectrum efficiency

- Network resources and bandwidth are only used when data is actually transferred.

- Internet Aware

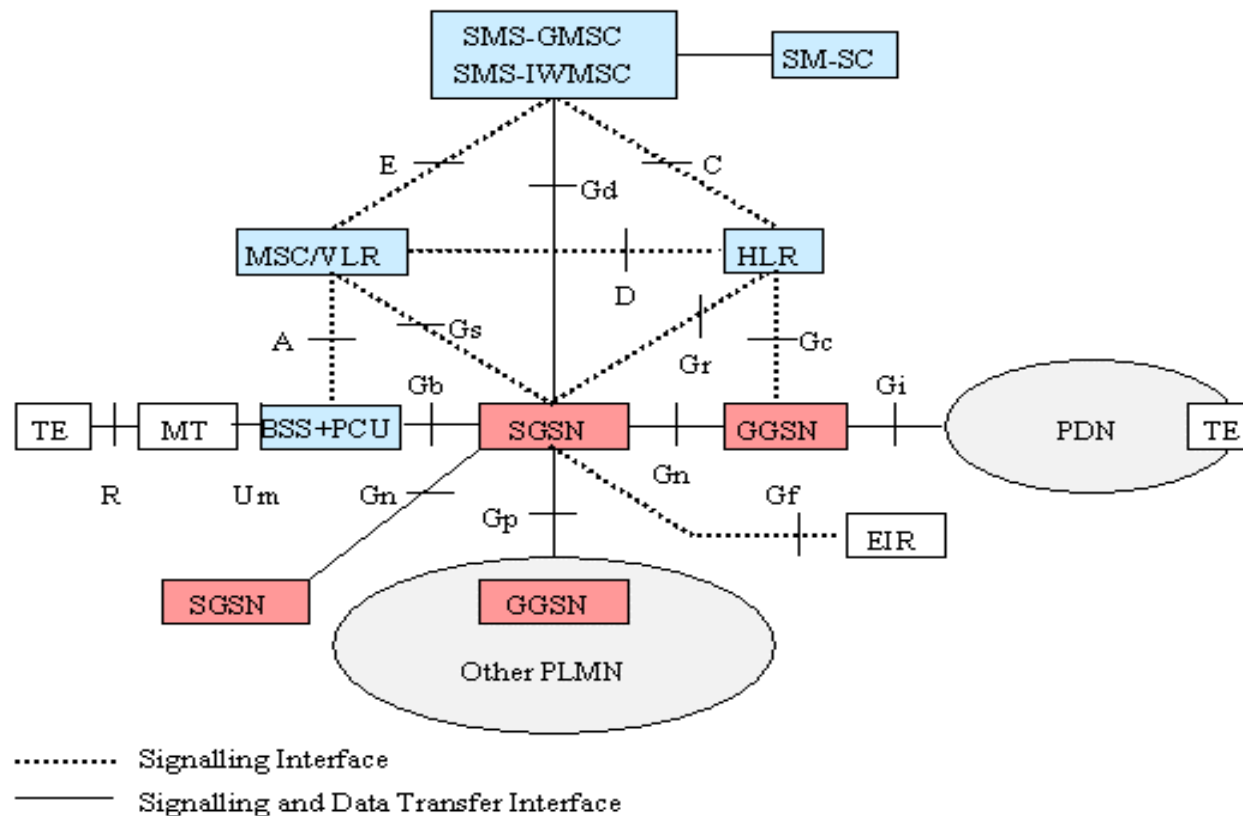
- Any service that is used over the fixed Internet today (FTP, web browsing, telnet ...) will be available over the mobile network.

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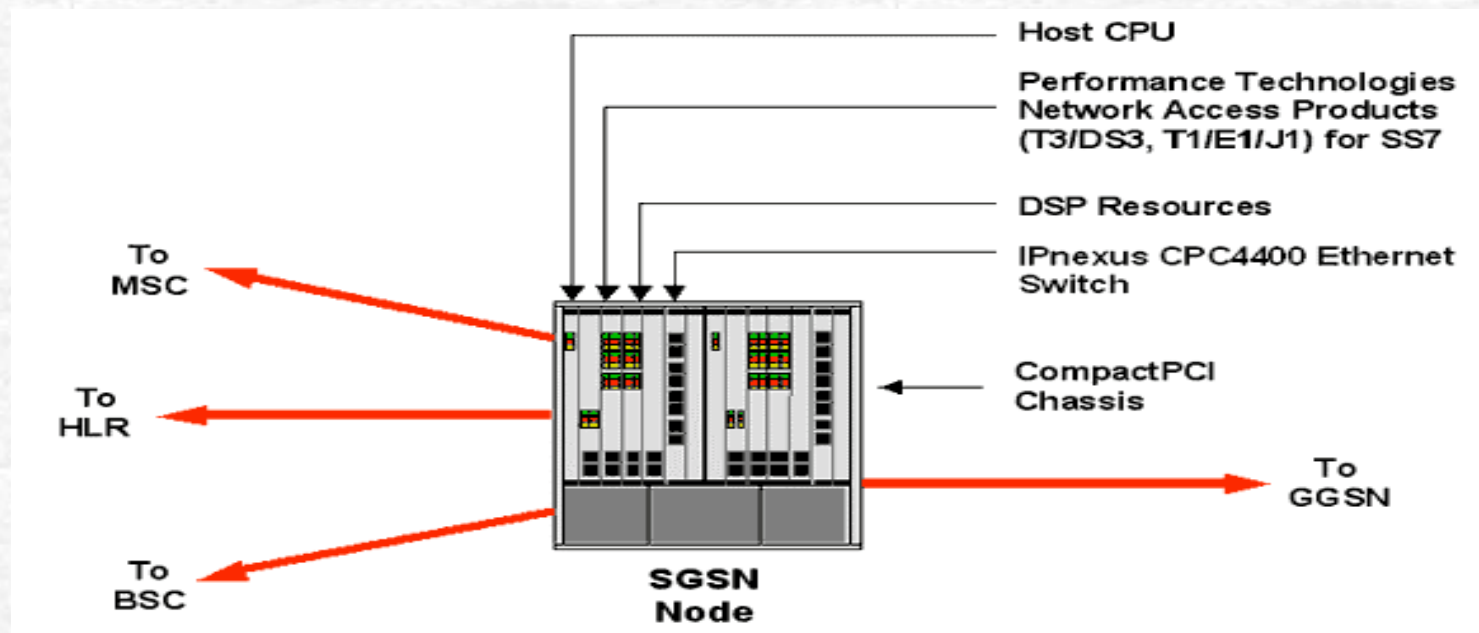
PART 2: GENERAL ARCHITECTURE

Entities and Interfaces



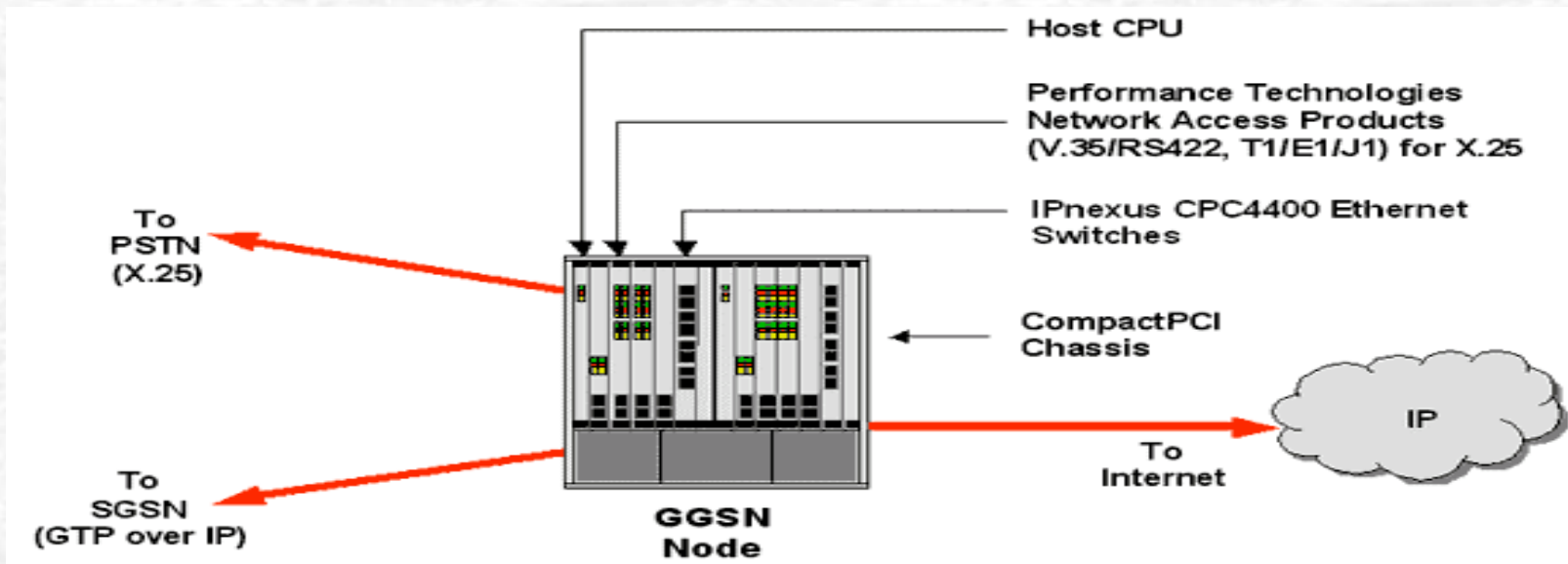
SGSN

- viewed as a « packet-switched MSC »
- delivers packets to MS
- sends queries to HLR
- detects new GPRS MS in a given service area
- performs mobility management functions
- connected to the BSC

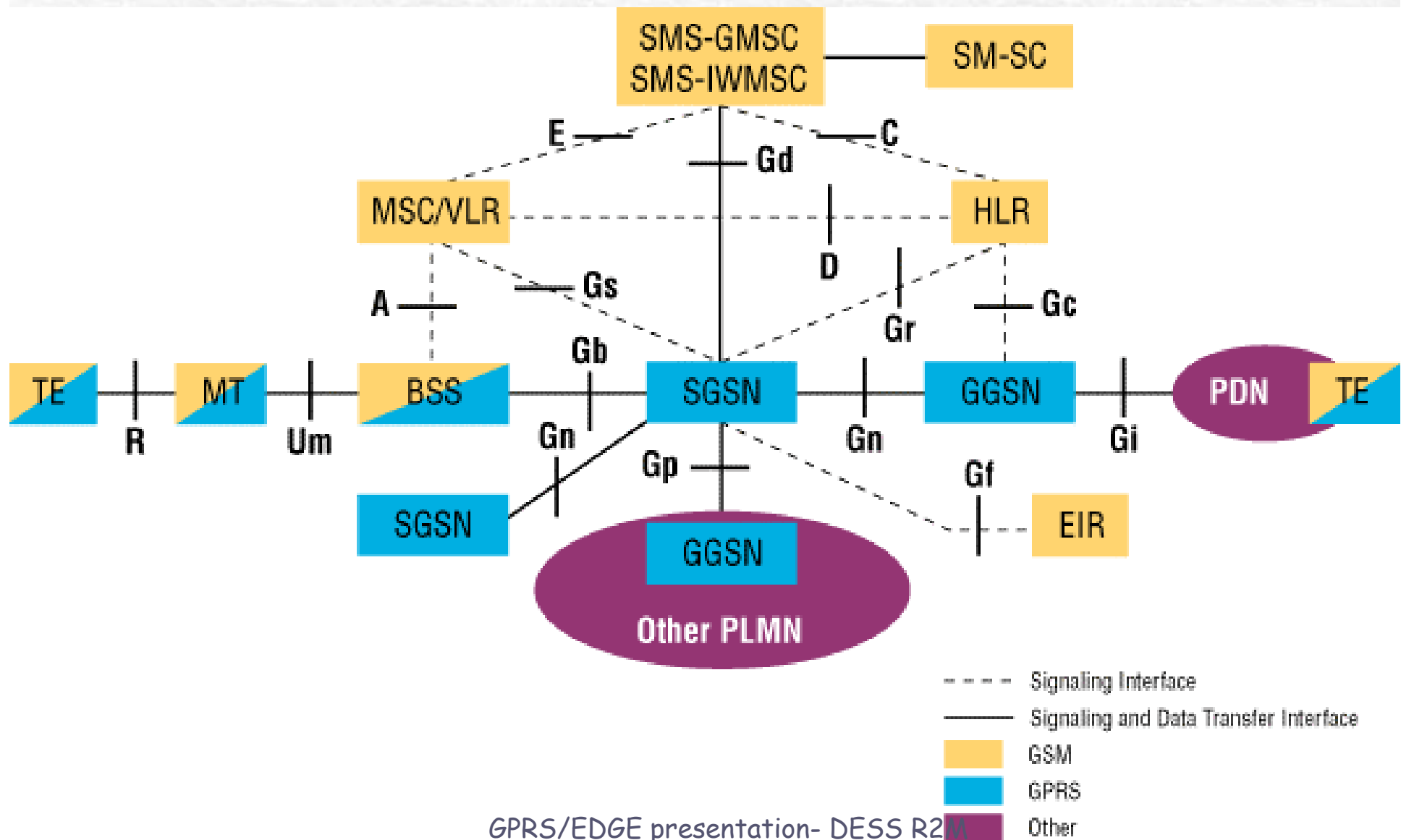


GGSN

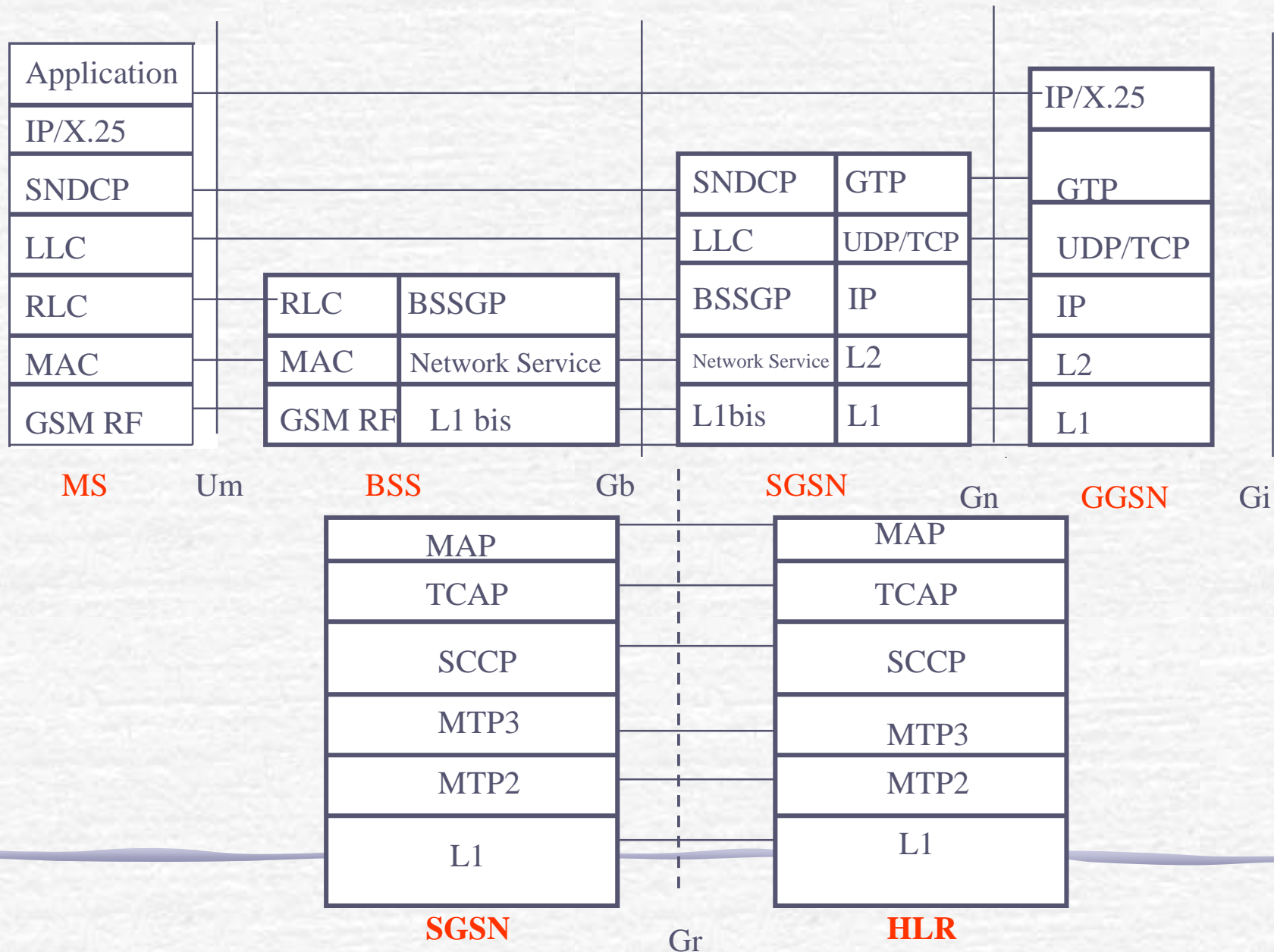
- gateway between the GPRS network and PDN (IP, X.25)
- maintains routing information to tunnel the PDU to the SGSNs
- connected to other GPRS networks to facilitate GPRS roaming.



Interfaces



Layer Architecture



GPRS Network Protocols

- SNDCP
 - Sub-Network Dependent Convergence Protocol
 - Compression, Segmentation and Multiplexing of network layer messages towards a single virtual connection
- LLC
 - Logical Link Control
 - it ensures the reliable transfer of user data across a wireless network (MS and SGSN)
- BSSGP
 - Base Station System GPRS Protocol
 - Routing and Qos information for the BSS
- GTP
 - GPRS Tunnelling Protocol
 - tunnels the protocol data units through the IP backbone by adding routing information

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GPRS Mobiles

- Several types of phones :
 - **Type 2+1**: 2 downlink channels and 1 uplink data transmission channel
 - **Type 3+1**: 3 downlink channels and 1 uplink data transmission channel
 - **Type 4+1**: 4 downlink channels and 1 uplink data transmission channel
- Data transmission Speeds:
 - The supported data transmission speed per channel → 13.4Kb/s

| | Receive | Send |
|-----------------|----------|----------|
| Type 2+1 | 26.8Kb/s | 13.4Kb/s |
| Type 3+1 | 40.2Kb/s | 13.4Kb/s |
| Type 4+1 | 53.6Kb/s | 13.4Kb/s |



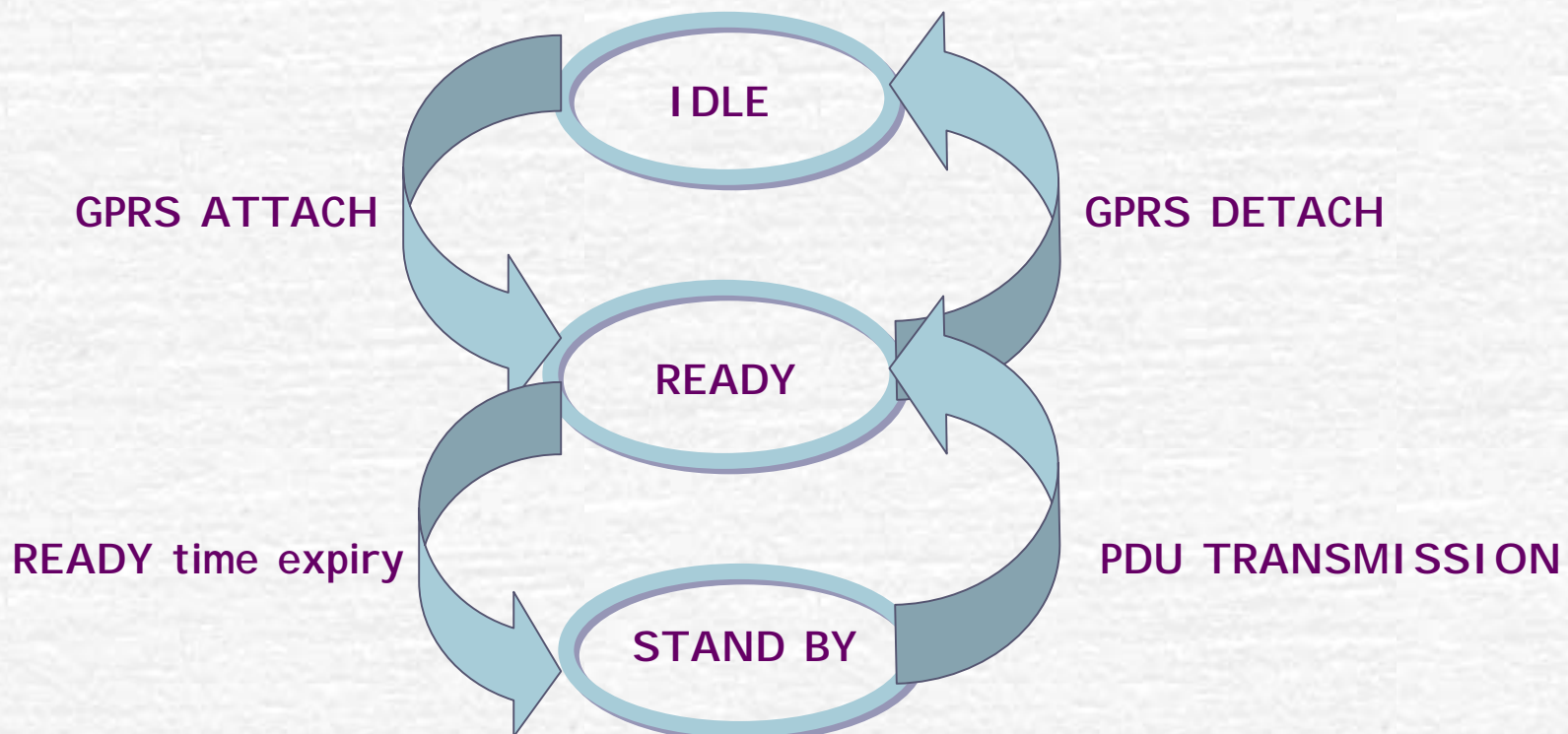
3 classes of mobile:

- **Class A:** simultaneous voice (via *GSM*) and data transmission (via *GPRS*).
- **Class B:** handsets are voice and packet data capable, but not at the same time.
- **Class C:** handsets can handle packet data only or they can be set manually to handle one or the other.

Part 3 ROAMING

3 different positions for the mobile:

- Idle
- Ready
- Stand by



GPRS-EDGE presentation-DESS R2M

Temporary identity

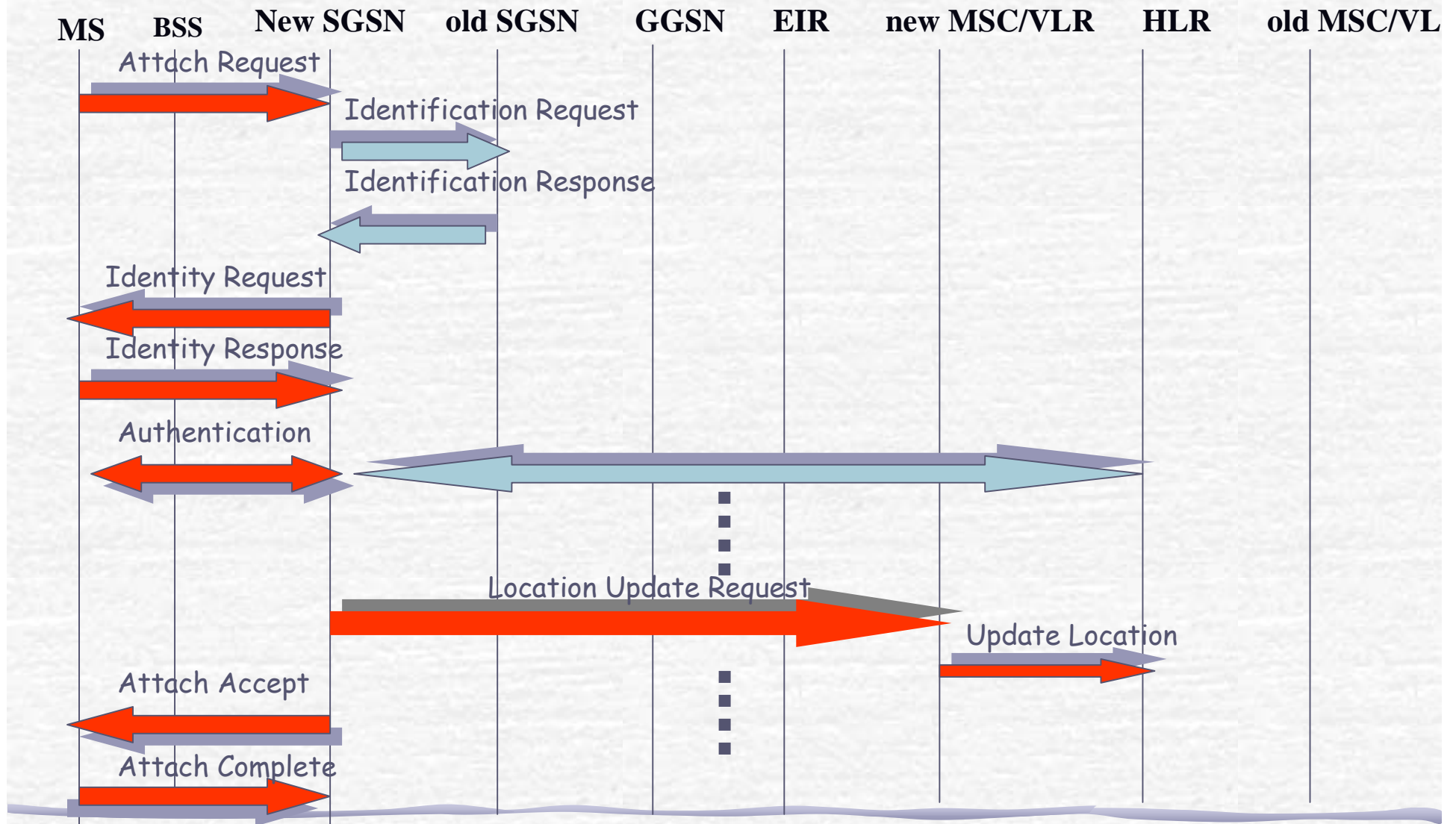
- P-TMSI: Packet temporary Mobile Subscriber Identity:

- »like the TMSI
- »short identity
- »after an attachment

- TLLI: Temporary Link Layer Identity

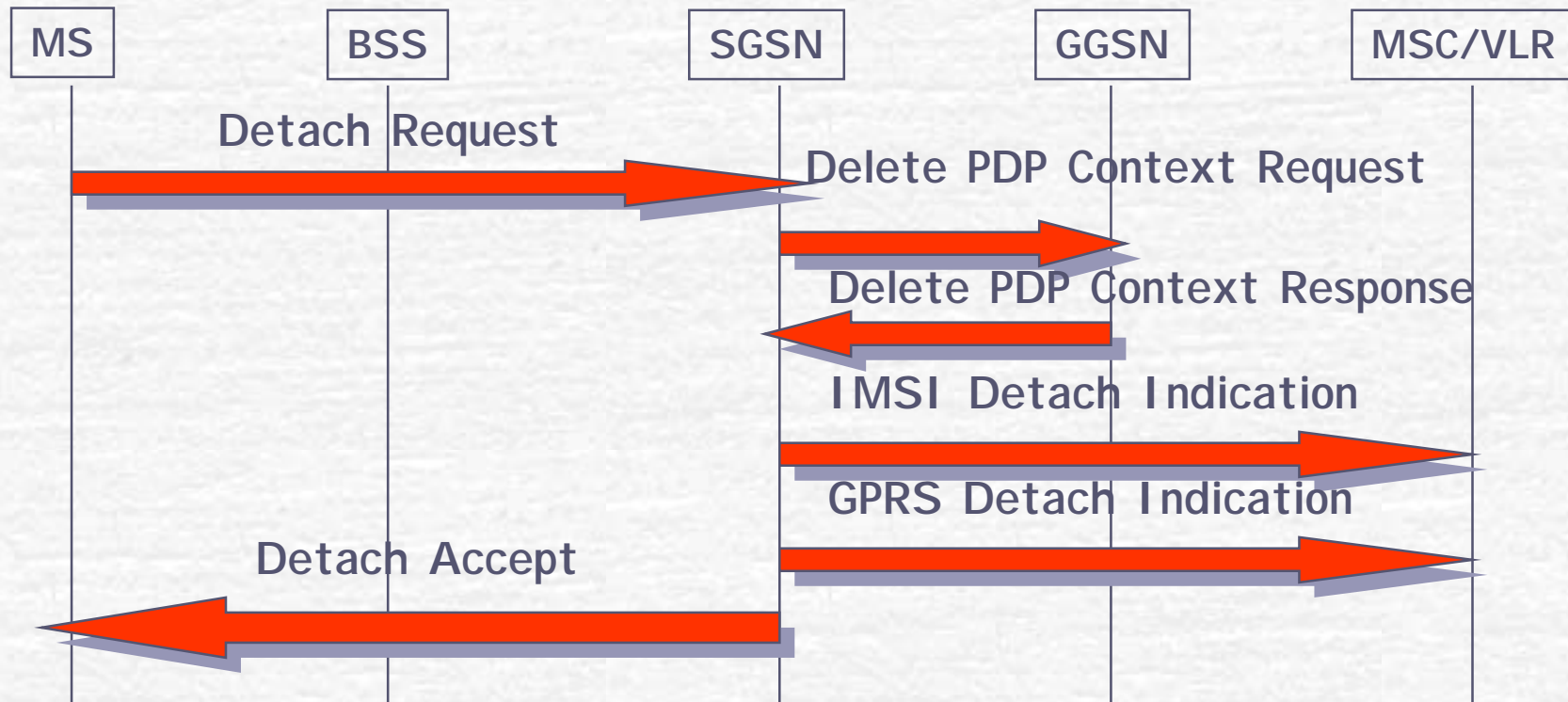
- »during the procedure of attachment
- »logical line between the mobile and the SGSN

Attach GPRS



GPRS Detach

MS-initiated Combined GPRS/IMSI Detach Procedure



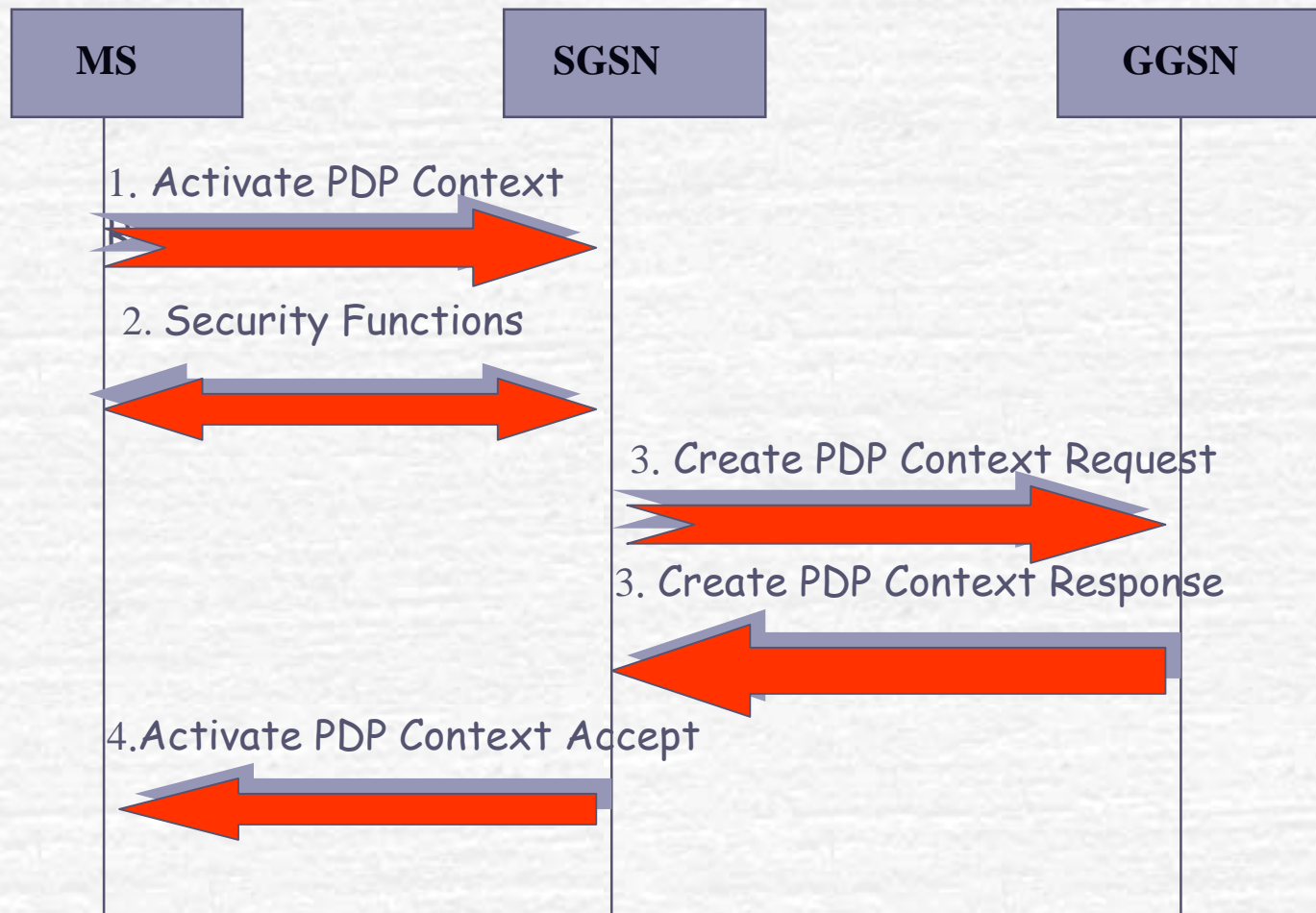
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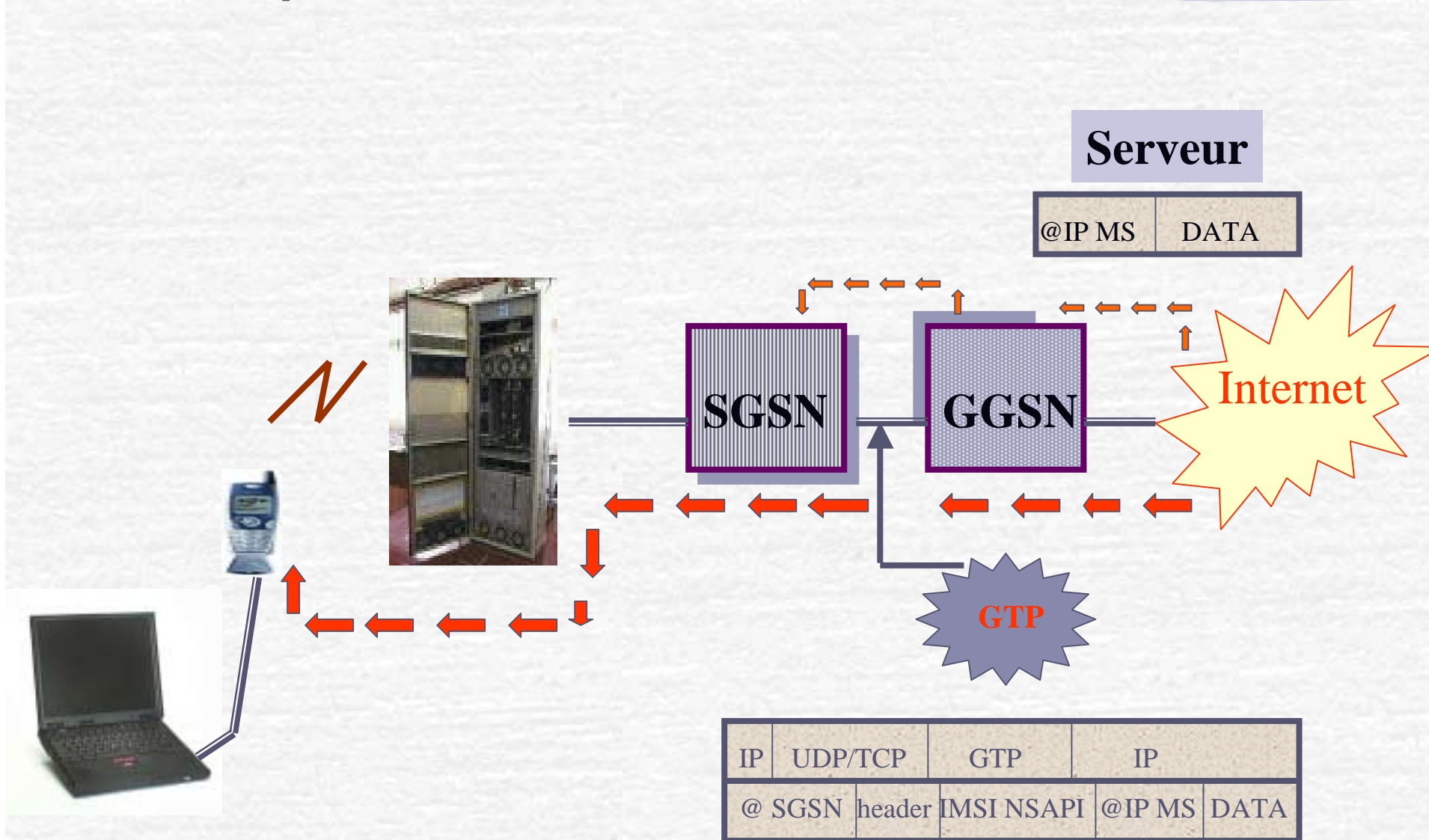
Part4: Session

- PDP Context: Definition
 - Information stocked in the mobile, GGSN or SGSN to permit the exchange of the data with PDP network.
 - To send and receive data, GPRS mobile should
 - be attached to the network
 - activate a PDP context
- PDP context: Contents
 - type of the PDP Network (IP or X.25)
 - address of terminal (IP or X.25)
 - IP address of SGSN
 - NSAPI
 - APN: Logical name of the external network (www.internet.com)
 - Qos

PDP Context Activation Procedure by MS



Example



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PART 5: GPRS Radio

- 4 Coding Schemes
- CSs represent protection level of packets .
- Protection of data limits rate.
- Radio Block = Data users + USF (Uplink Status Flag)
- GPRS signalling is transmitted in CS-1

Coding parameters for the GPRS coding schemes

| Scheme | Code Rate | USF | Pre-coded USF | Radio Block excl. USF and BCS | BCS | Tail | Coded bits | Punctured bits | Data rate kb/s |
|--------|-----------|-----|---------------|-------------------------------|-----|------|------------|----------------|----------------|
| CS-1 | 1/2 | 3 | 3 | 181 | 40 | 4 | 456 | 0 | 9.05 |
| CS-2 | 2/3 | 3 | 6 | 268 | 16 | 4 | 588 | 132 | 13.4 |
| CS-3 | 3/4 | 3 | 6 | 312 | 16 | 4 | 676 | 220 | 15.6 |
| CS-4 | 1 | 3 | 12 | 428 | 16 | - | 456 | - | 21.4 |

Packet logical channel

- PDTCH (Packet Data Transfer Channel) for data users.
- PACCH (Packet Associated Control Channel) for acknowledging and power control.
- PTCCH (Packet Timing Control Channel) for timing advance of a group of mobiles.
- Channel of GSM (BCCH, PCH, RACH, AGCH) or specific channel GPRS (with P)

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GPRS/EDGE presentation- DESS R2M

Part6: Applications for GPRS

- Communications: intranet access, internet applications like e-mail, web browsing, video telephone, network game, electronic commerce.
- Voice and audio applications: high quality voice, music.
- Specialised applications: telemedecine, location service (vehicle positioning)

GPRS Applications



Limitations of GPRS

- Speed much lower in reality: the network operator will not allow all timeslots to be used by a single GPRS user.
- Sub optimal modulation: GPRS is based on a modulation GMSK (Gaussian minimum shift keying) modulation.
- Transit delay: GPRS packets are sent in all different directions to reach the same destination.

GPRS CONCLUSION

- GPRS: Mobile network with Packet Switching
- Rate of 171.2 kbits/s
- Applications and limitations
- EDGE: a rate of 384 kbits/s
- New modulation technique and coding schemes

Introduction

- EDGE: Enhanced Data Rates for Global Evolution.
- EDGE is the radio technology that allows operators to increase both data speeds and throughput capacity 3-4 times over GPRS.
- A major benefit of EDGE is that it enables existing TDMA carriers as well as GSM carriers to offer 3G services while still realising lower costs due to higher efficiency and higher data rates.

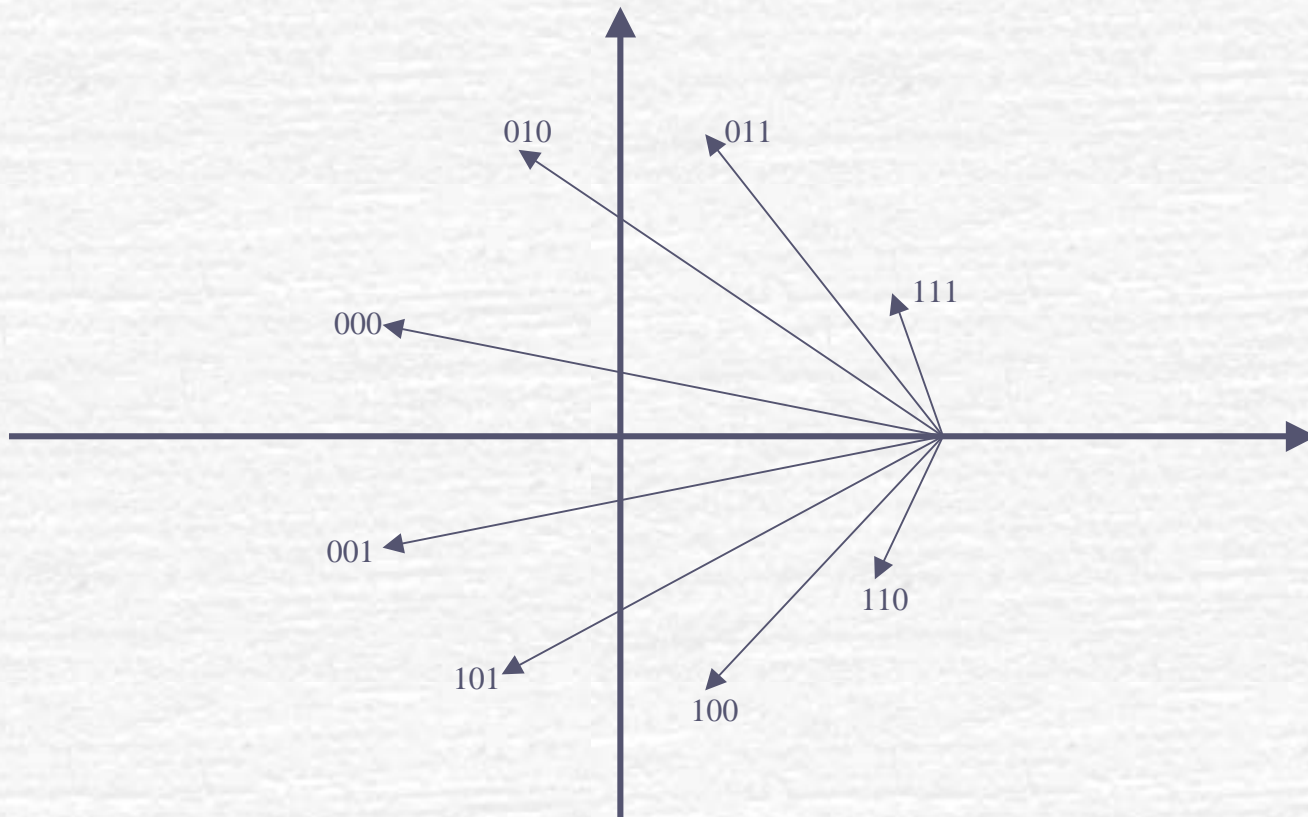
EDGE FEATURES

- 600 M subscribers of GSM in over 170 countries, so offering GSM enhanced with EDGE will enable full global roaming between the Americas, Europe and Asia.
- EDGE was formerly called GSM384, because it allows data transmission speeds of 384 Kbps.
- This speed could be achieved when all eight timeslots are used.

EDGE RATE

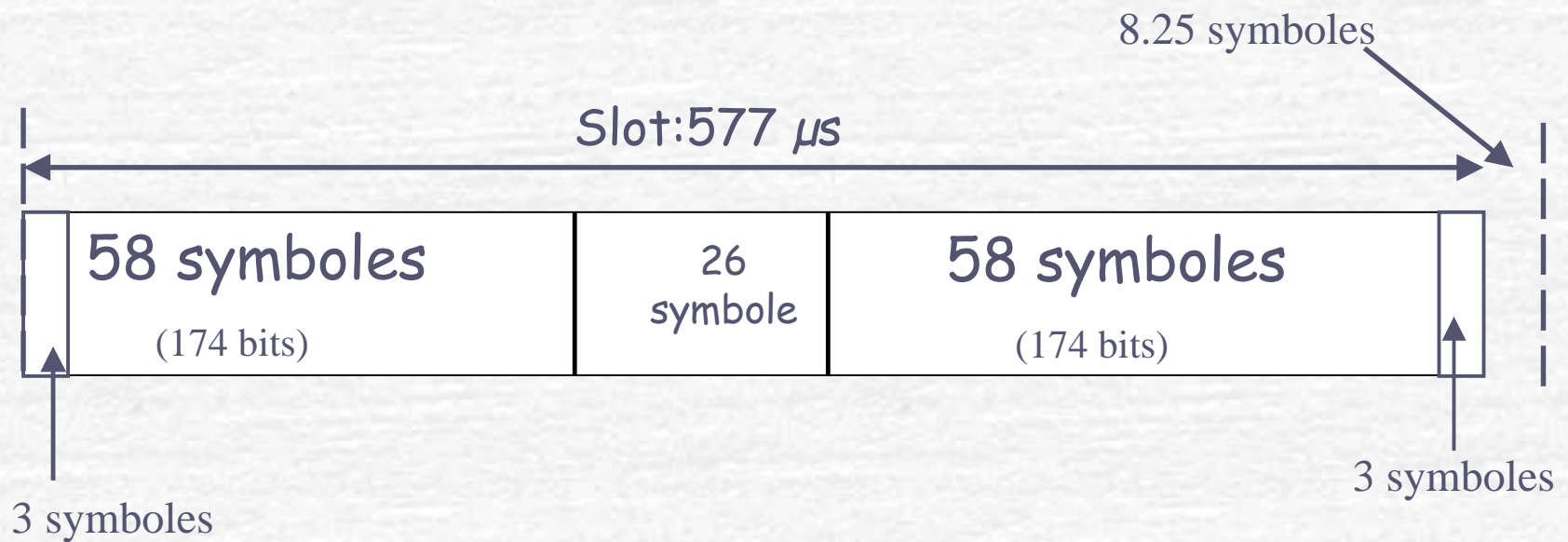
- The idea behind EDGE is to obtain even higher data rates on the current 200KHz GSM carrier by changing the type of modulation used.
- GPRS is based on the GMSK...
- EDGE is based on 8PSK which allows a much higher bit rate across the air interface.
- One symbol for every 3 bits so
Rate EDGE=3 x Rate GPRS

8-PSK Modulaion

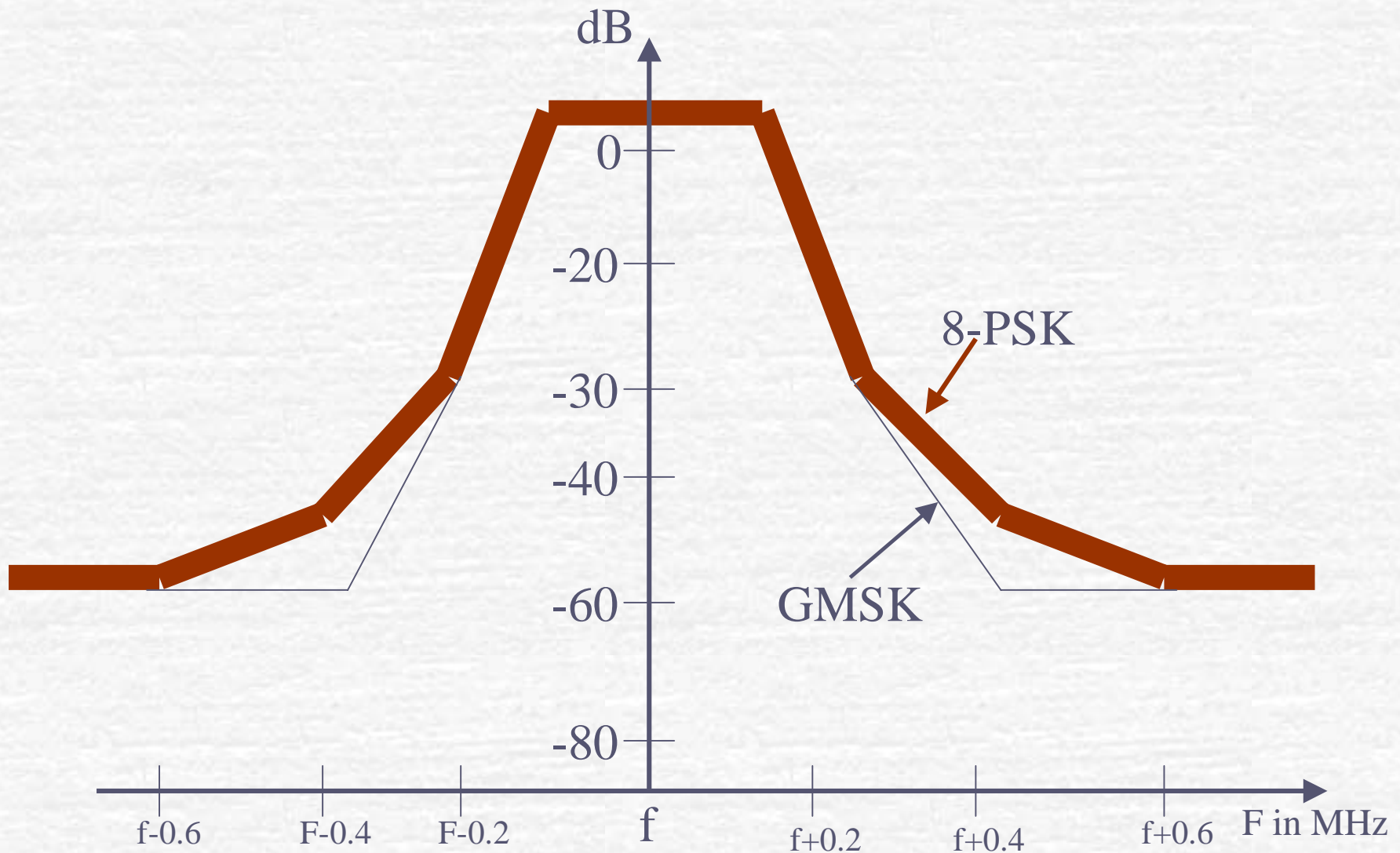


8-PSK Modulation

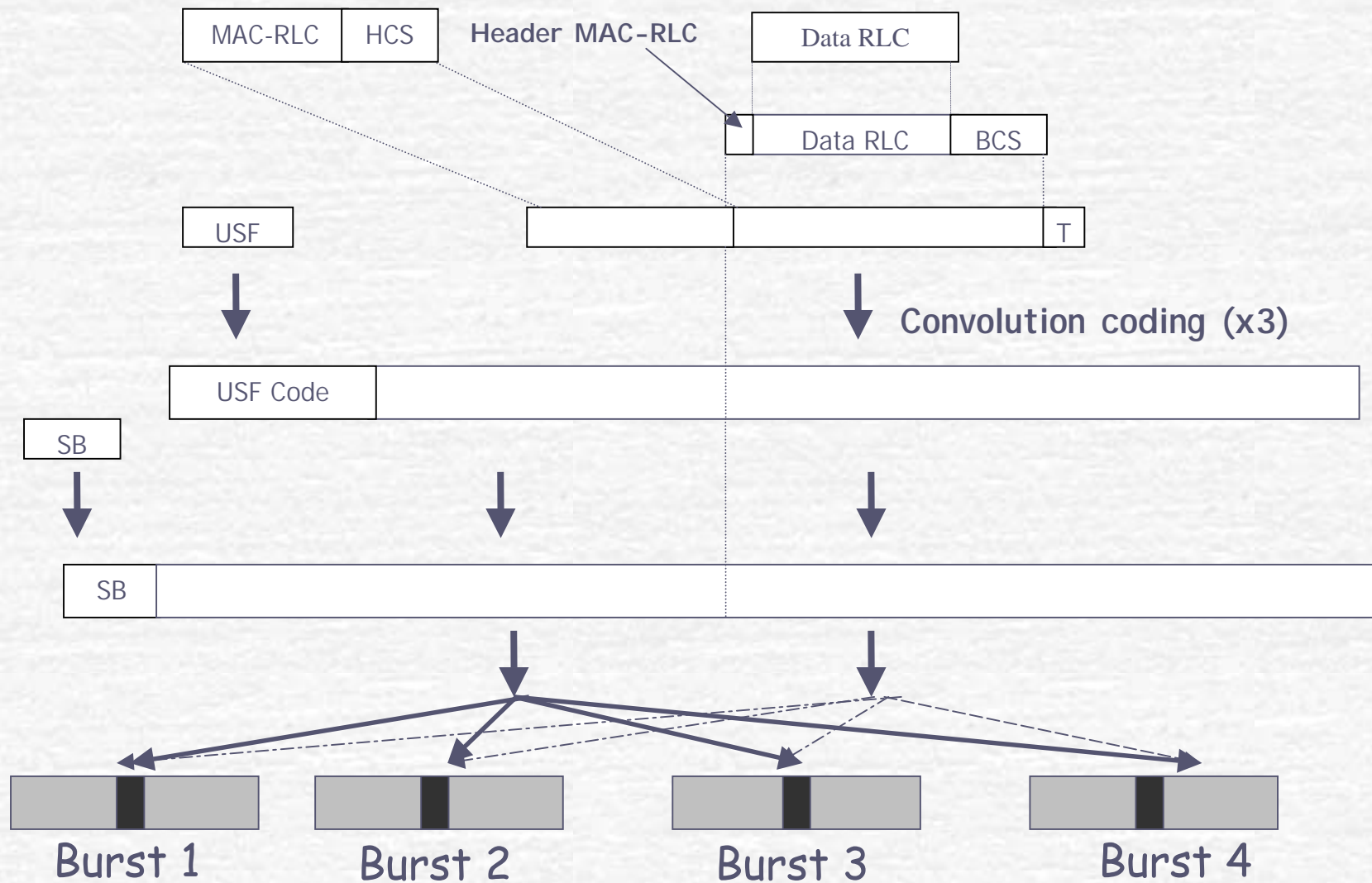
8-PSK Burst structure



GSM & EDGE modulations Spectrum



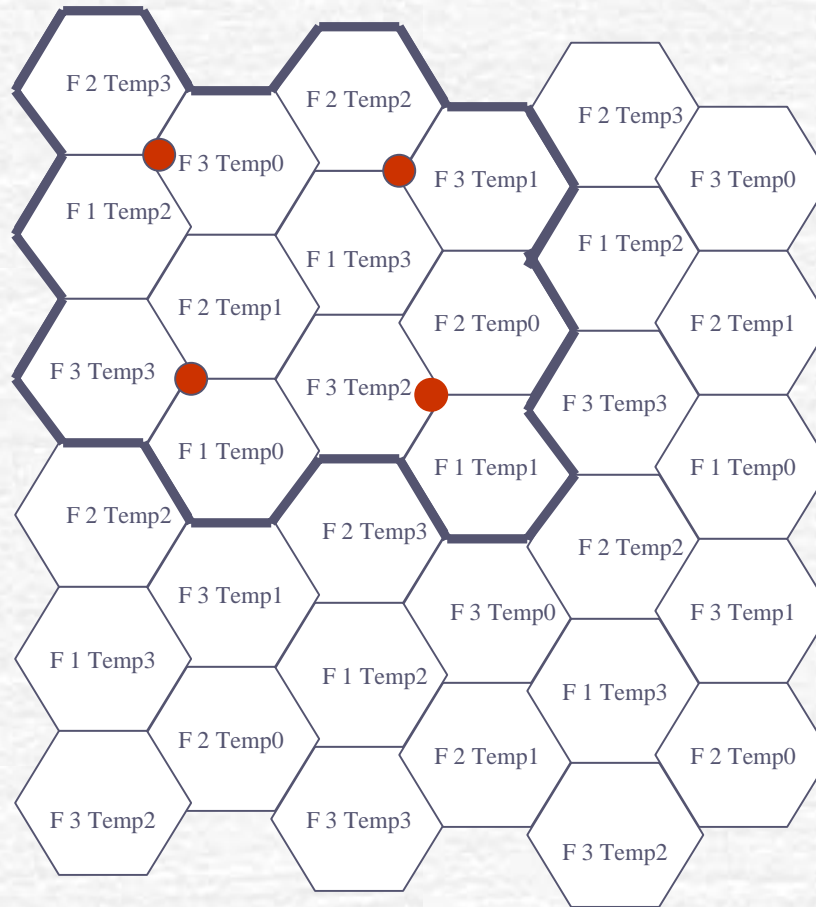
EDGE CODING



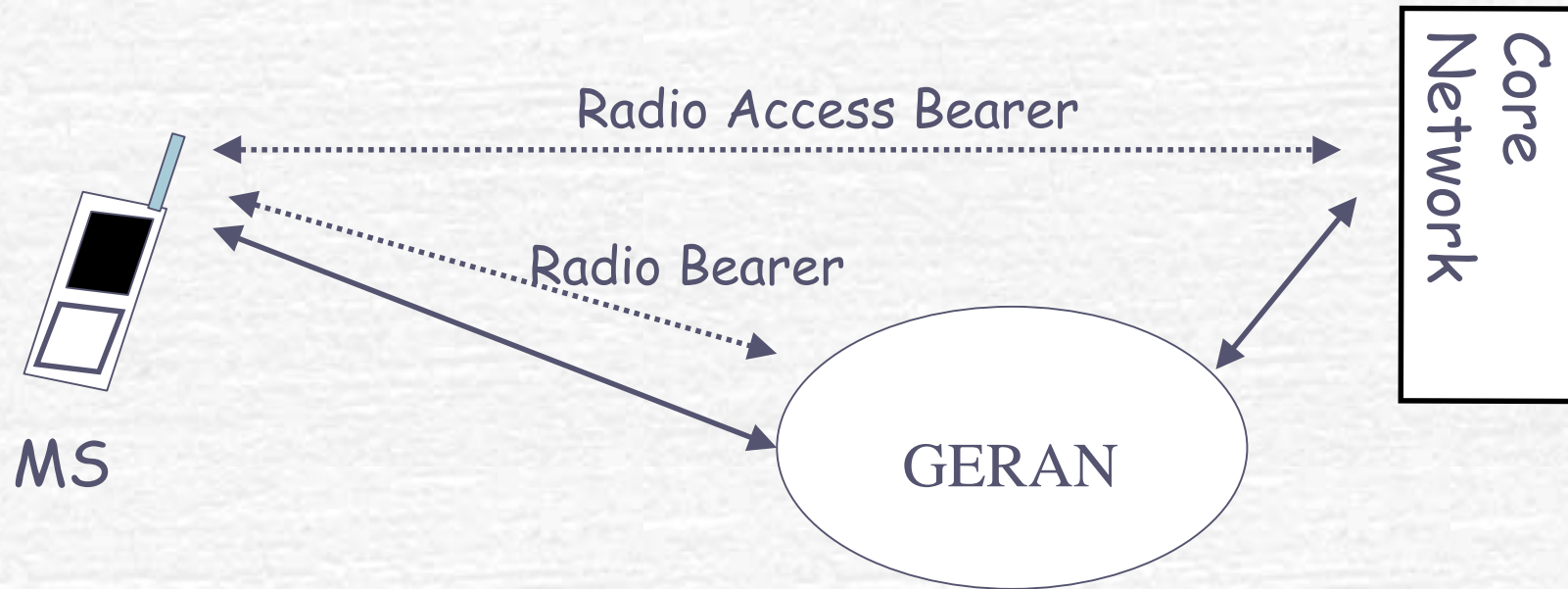
Parameters of the Modulation coding in EDGE

| Coding scheme | Type of modulation | RLC unit | Nominal rate (kb/s) | Rate of data coding | Rate of header coding |
|---------------|--------------------|----------|---------------------|---------------------|-----------------------|
| MCS-1 | GMSK | 22 | 8.8 | 0.53 | 0.53 |
| MCS-2 | | 28 | 11.2 | 0.66 | 0.53 |
| MCS-3 | | 37 | 14.8 | 0.85 | 0.53 |
| MCS-4 | | 44 | 17.6 | 1 | 0.53 |
| MCS-5 | 8-PSK | 56 | 22.4 | 0.37 | 1/3 |
| MCS-6 | | 74 | 29.6 | 0.49 | 1/3 |
| MCS-7 | | 2*56 | 44.8 | 0.76 | 0.36 |
| MCS-8 | | 2*68 | 54.4 | 0.92 | 0.36 |
| MCS-9 | | 2*74 | 59.2 | 1 | 0.36 |

Planification in EDGE compact



Support Radio access in EDGE



Conclusion

- EDGE will have little technical impact, since it is fully based on GSM, and will require small changes to the network structure, or invest in new licenses.
- Ex:EDGE uses the same TDMA frame structure, logic channel and 200kHz carrier bandwidth as today's GSM networks.
- With EDGE, operators can offer more wireless data application including wireless multimedia, e-mail, web infotainment and videoconferencing