

RFTD 201: Introduction to GPRS (General Packet Radio Service)



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Agenda

Introduction

- What / Why
- Typical User Session

Network Description

Protocol

- Stacks
- Layer Highlights

EGPRS

The What and Why of GPRS

Why?

- Mobile internet over GSM
 - Data charged per byte not per second
 - Variable bandwidth

What?

- Packet data system (IP and X.25 supported)
- Extension to GSM
- 'Always on' connection
- Mobility support

User Scenario

Power up mobile

- GPRS Attach

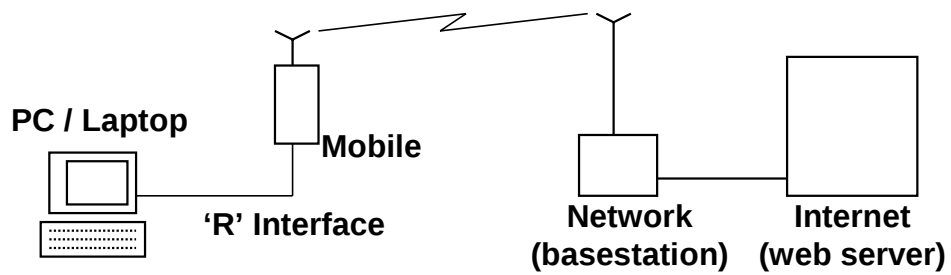
Establish Connection

- PDP Context Activation

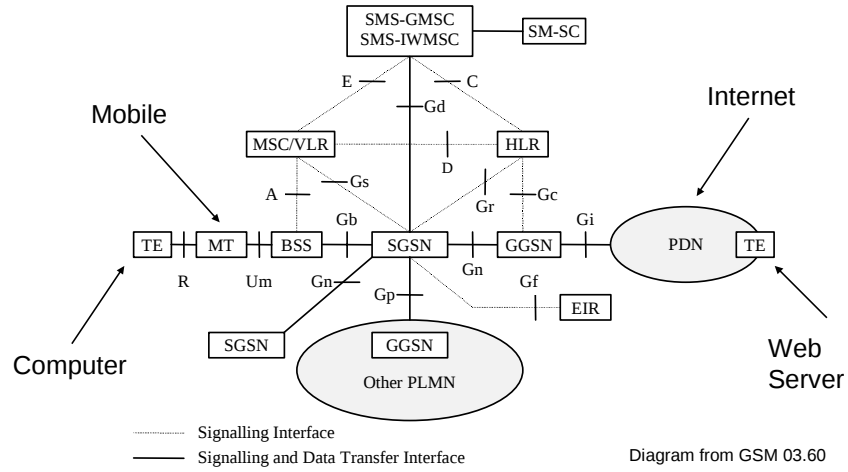
Surf the web

- Temporary Block Flows (TBF)

Finally, deactivate & detach



Network Architecture



SGSNs, GGSNs and other stuff

SGSN (Serving GPRS Support Node)

- Manages mobility
- Changes as mobile roams

GGSN (Gateway GPRS Support Node)

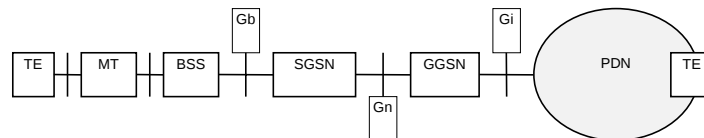
- Gateway to internet
- Stays constant

BSS (Base Station Subsystem)

- Radio interface

PDN (Packet Data Network)

- The internet!



Mobile Capabilities

GPRS Mobile Classes

- Class A: simultaneous voice / GPRS operation
- Class B: Either voice or GPRS at any one time
- Class C: GPRS only (or manual switch to voice)

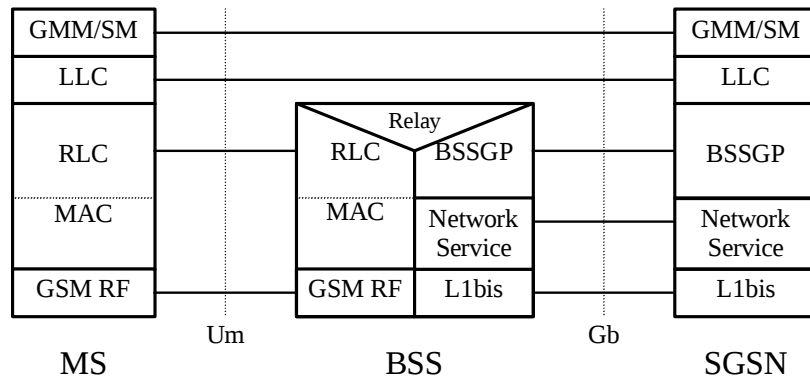
Bandwidth Capability

- Multislot class

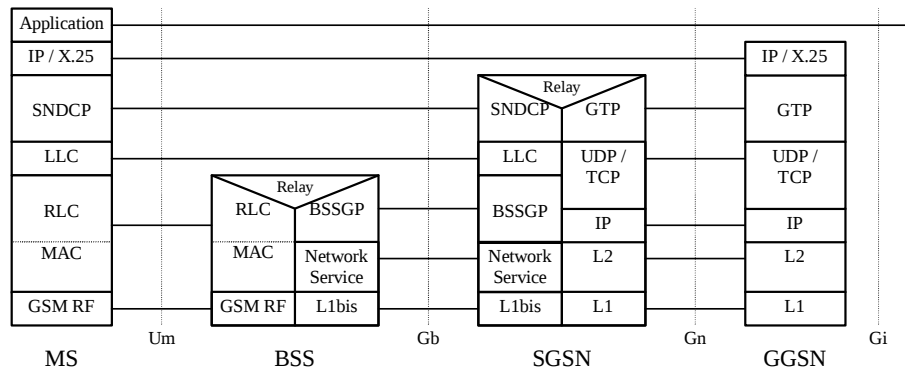
QoS profiles

- Throughput / delay / reliability

Signalling Protocol Stacks



Traffic Protocol Stacks

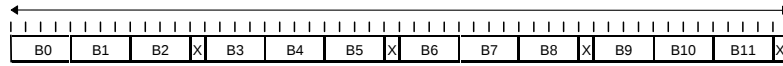


Layer 1 Highlights

Extension to existing GPRS Layer 1

- GMSK modulation scheme unchanged
- Basic 8 timeslot TDMA frame unchanged
- New physical channel (PDCH) and associated multiframe
- New logical channels (PDTCH, PACCH, PBCCH...)
- New coding schemes (CS1 - CS4)
- New timing advance mechanisms

Layer 1 Multiframe



52 TDMA frames

B0 - B11: Radio Blocks (4 TDMA frames)

X: Idle frame

4 bursts = 1 radio block

Each block is assigned to a logical channel

- PDTCH - packet data traffic channel
- PACCH - packet associated control channel
- PBCCH - packet broadcast control channel
- PAGCH - packet access grant channel
- PRACH - packet random access channel

Layer 1 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	$\approx 2/3$	3	6	268	16	4	588	132	13.4
CS-3	$\approx 3/4$	3	6	312	16	4	676	220	15.6
CS-4	1	3	12	428	16	-	456	-	21.4

4 different coding schemes

- CS-1 high detection & correction / low data rate (9.05 kbs)
- CS-4 detection only / high data rate (21.4 kbs)

Signalling always uses CS-1

Normal GSM (SACCH) interleaving

RLC/MAC Highlights

Radio Link Control / Medium Access Control

- Mediates access across multiple mobiles (MAC)
- Procedures to transfer data (RLC)

Temporary Block Flow (TBF)

- One 'burst' of data to/from one mobile in one direction
- Many TBFs can be active
- Acknowledged or unacknowledged mode
- Signalling and data both use TBFs

MAC

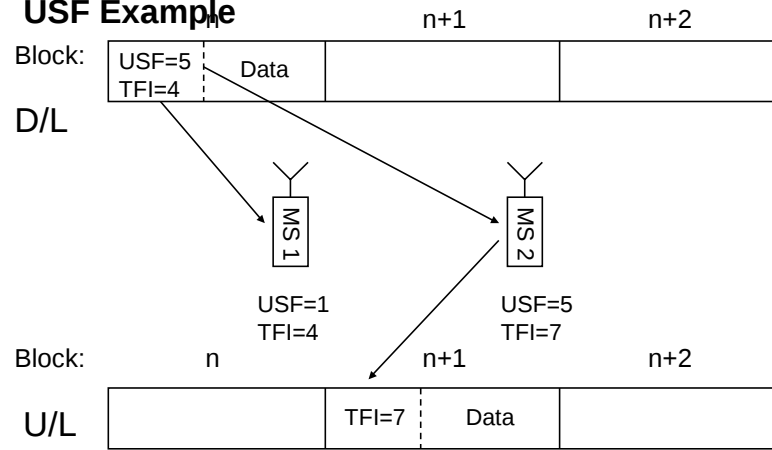
Downlink (to mobile)

- Blocks addressed by Temporary Flow Identity (TFI)

Uplink

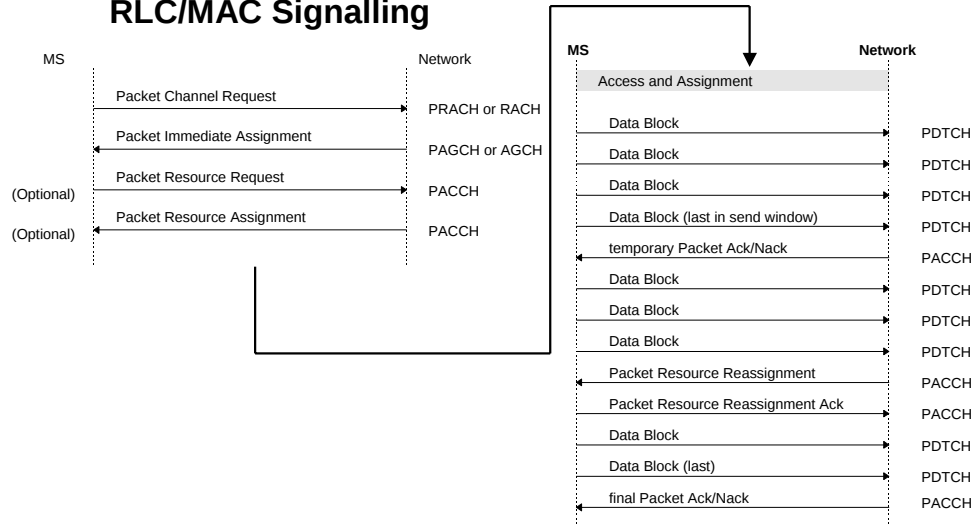
- Fixed Access
 - Mobiles given list of blocks to use
- Dynamic Access
 - Block by block allocation
 - Uplink State Flag (USF) on downlink allocates next uplink block

USF Example



USF = Uplink State Flag, TFI = Temporary Flow ID

RLC/MAC Signalling



LLC Highlights

LLC - Logical Link Control

- Air interface independent
- Discriminates between signalling and data
- Acknowledged or unacknowledged mode
- Encryption / decryption

GMM/SM Highlights

GMM - GPRS Mobility Management

- Location tracking
 - Attach / detach / cell update / routing area update
- Authentication

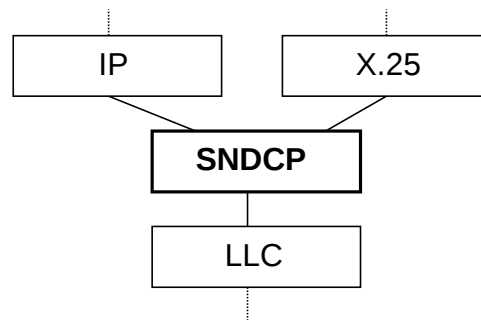
SM - Session Management

- Packet Data Protocol (PDP) Context management
 - Activation / deactivation / modification
 - Anonymous service available
 - Static or dynamic addresses

SNDCP Highlights

SNDCP - Subnetwork Dependent Convergence Protocol

- Multiplexes multiple application protocols
- Optional compression
- Segmentation / reassembly

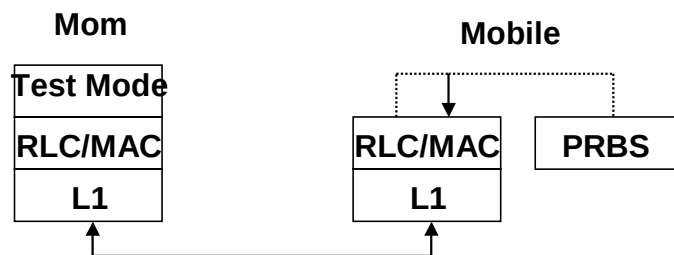


ETSI Test Mode

Avoids need for external MS control on production line

Causes either data to be internally generated or looped back

Entered by sending the mobile a TEST_MODE_START_REQ message



EGPRS

Extension of GPRS to include EDGE modulated physical channels

New L1 coding schemes

Minimal upper layer changes

- New channel types, classmarks etc
- Larger RLC window sizes

Fallback to GMSK in areas of poor signal strength / quality

BCCH still uses GMSK

EDGE Modulation

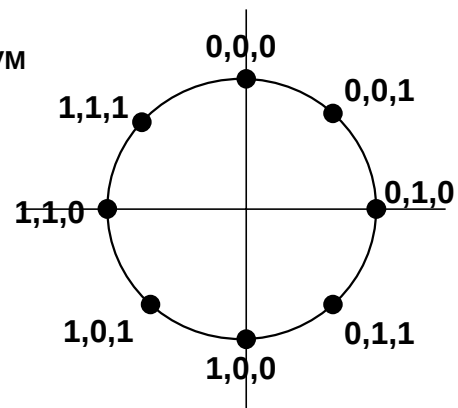
8PSK with $3\pi/8$ rotation to avoid zero crossings

Each symbol = 3 bits

Works with existing mobiles

Modulation measurement now EVM

PvT mask relaxed



Thank you.

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