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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Special Mobile Group (SMG).

The present document defines the stage-2 service description for a General Packet Radio Service (GPRS) within the digital cellular telecommunications system (Phase 2+).

The contents of the present document are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will then be re-submitted for OAP with an identifying change of release date and an increase in version number as follows:

Version 6.x.y

where:

6 indicates GSM Release 1997 of Phase 2+

x the second digit is incremented for changes of substance, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated in the specification.

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1 Scope

The present document defines the stage-2 service description for a General Packet Radio Service (GPRS) on GSM. CCITT Recommendation I.130 [28] describes a three-stage method for characterisation of telecommunication services, and CCITT Recommendation Q.65 [30] defines stage 2 of the method.

This version of the stage-2 service description covers the first phase of GPRS, and does not meet all the services and functionality described in GSM 02.60 [3].

The present document does not cover the lower layers of the GPRS GSM radio interface. GSM 03.64 [9] contains an overall description of the radio interface.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1997 document, references to GSM documents are for Release 1997 versions (version 6.x.y).

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); GPRS ciphering algorithm requirements".

[3] GSM 02.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 1".

[4] GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".

[5] GSM 03.07: "Digital cellular telecommunications system (Phase 2+); Restoration procedures".

[6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[7] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".

[8] GSM 03.40: "Digital cellular telecommunications system (Phase 2+); Technical realization of the Short Message Service (SMS); Point-to-Point (PP)".

[9] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); Overall description of the General Packet Radio Service (GPRS) Radio interface; Stage 2".

[10] GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".

[11] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[12] GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".

[13] GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station – Serving GPRS Support Node (MS - SGSN) Logical Link Control (LLC) layer specification".

[14] GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[15] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[16] GSM 07.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS".

[17] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification".

[18] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".

[19] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".

[20] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[21] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

[22] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".

[23] GSM 09.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".

[24] GSM 09.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".

[25] GSM 09.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[26] GSM 09.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".

[27] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[28] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[29] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[30] CCITT Recommendation Q.65: "Methodology – Stage 2 of the method for the characterization of services supported by an ISDN".

[31] CCITT Recommendation V.42 bis: "Data communication over the telephone network – Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".

[32] CCITT Recommendation X.3: "Packet assembly disassembly facility (PAD) in a public data network".

[33] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[34] CCITT Recommendation X.28: "DTE / DCE interface for a start-stop mode data terminal equipment accessing the packet assembly / disassembly facility (PAD) in a public data network situated in the same country".

[35] CCITT Recommendation X.29: "Procedures for the exchange of control information and user data between a packet assembly / disassembly (PAD) facility and a packet mode DTE or another PAD".

[36] CCITT Recommendation X.75: "Packet-switched signalling system between public networks providing data transmission services".

[37] CCITT Recommendation X.121: "International Numbering Plan for Public Data Networks".

[38] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[39] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[40] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[41] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[42] IETF RFC 1034 (1987): "Domain Names – Concepts and Facilities" (STD 7).

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GSM 02.60 apply.

3.2 Abbreviations

For the purposes of the present document the following abbreviations apply. Additional applicable abbreviations can be found in GSM 01.04 [1].

AA	Anonymous Access
APN	Access Point Name
ATM	Asynchronous Transfer Mode
BG	Border Gateway
BSSAP+	Base Station System Application Part +
BSSGP	Base Station System GPRS Protocol
BVCI	BSSGP Virtual Connection Identifier
CCU	Channel Codec Unit
CGI	Cell Global Identification
CS	Circuit Switched
DNS	Domain Name System
GGSN	Gateway GPRS Support Node
GMM/SM	GPRS Mobility Management and Session Management
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
ICMP	Internet Control Message Protocol

IETF	Internet Engineering Task Force
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISP	Internet Service Provider
LLC	Logical Link Control
LL-PDU	LLC PDU
MAC	Medium Access Control
MNRF	Mobile station Not Reachable Flag
MNRG	Mobile station Not Reachable for GPRS flag
MNRR	Mobile station Not Reachable Reason
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NGAF	Non-GPRS Alert Flag
NS	Network Service
NSAPI	Network layer Service Access Point Identifier
NSS	Network SubSystem
PCU	Packet Control Unit
PDCH	Packet Data CHannel
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g., IP or X.25 [33]
PDU	Protocol Data Unit
PPF	Paging Proceed Flag
P-TMSI	Packet TMSI
PVC	Permanent Virtual Circuit
RA	Routeing Area
RAC	Routeing Area Code
RAI	Routeing Area Identity
RLC	Radio Link Control
SGSN	Serving GPRS Support Node
SM	Short Message
SM-SC	Short Message service Service Centre
SMS-GMSC	Short Message Service Gateway MSC
SMS-IWMSC	Short Message Service Interworking MSC
SNDC	SubNetwork Dependent Convergence
SNDCP	SubNetwork Dependent Convergence Protocol
SN-PDU	SNDCP PDU
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TID	Tunnel Identifier
TLLI	Temporary Logical Link Identity
TRAU	Transcoder and Rate Adaptor Unit
UDP	User Datagram Protocol

3.3 Symbols

For the purposes of the present document the following symbols apply:

Gb	Interface between an SGSN and a BSS.
Gc	Interface between a GGSN and an HLR.
Gd	Interface between a SMS-GMSC and an SGSN, and between a SMS-IWMSC and an SGSN.
Gf	Interface between an SGSN and an EIR.
Gi	Reference point between GPRS and an external packet data network.
Gn	Interface between two GSNs within the same PLMN.
Gp	Interface between two GSNs in different PLMNs. The Gp interface allows support of GPRS network services across areas served by the co-operating GPRS PLMNs.
Gr	Interface between an SGSN and an HLR.
Gs	Interface between an SGSN and an MSC/VLR.
kbit/s	Kilobits per second.
R	Reference point between a non-ISDN compatible TE and MT. Typically this reference point supports a standard serial interface.

Um Interface between the mobile station (MS) and the GPRS fixed network part. The Um interface is the GPRS network interface for providing packet data services over the radio to the MS. The MT part of the MS is used to access the GPRS services through this interface.

4 Main Concepts

GPRS uses a packet-mode technique to transfer high-speed and low-speed data and signalling in an efficient manner. GPRS optimises the use of network and radio resources. Strict separation between the radio subsystem and network subsystem is maintained, allowing the network subsystem to be reused with other radio access technologies. GPRS does not mandate changes to an installed MSC base.

New GPRS radio channels are defined, and the allocation of these channels is flexible: from 1 to 8 radio interface timeslots can be allocated per TDMA frame, timeslots are shared by the active users, and up and downlink are allocated separately. The radio interface resources can be shared dynamically between speech and data services as a function of service load and operator preference. Various radio channel coding schemes are specified to allow bitrates from 9 to more than 150 kbit/s per user.

Applications based on standard data protocols are supported, and interworking is defined with IP networks and X.25 networks. GPRS allows SMS transfer over GPRS radio channels.

GPRS is designed to support from intermittent and bursty data transfers through to occasional transmission of large volumes of data. Several quality of service profiles are supported. GPRS is designed for fast reservation to begin transmission of packets, typically 0,5 to 1 second. Charging should typically be based on the amount of data transferred.

Three GPRS MS modes of operation are supported: An MS in class-A mode of operation operates GPRS and other GSM services simultaneously. An MS in class-B mode of operation monitors control channels for GPRS and other GSM services simultaneously, but can only operate one set of services at one time. An MS in class-C mode of operation exclusively operates GPRS services.

GPRS introduces two new network nodes in the GSM PLMN: The Serving GPRS Support Node (SGSN), which is at the same hierarchical level as the MSC, keeps track of the individual MSs' location and performs security functions and access control. The SGSN is connected to the base station system with Frame Relay. The Gateway GSN (GGSN) provides interworking with external packet-switched networks, and is connected with SGSNs via an IP-based GPRS backbone network. The HLR is enhanced with GPRS subscriber information, and the SMS-GMSCs and SMS-IWMSCs are upgraded to support SMS transmission via the SGSN. Optionally, the MSC/VLR can be enhanced for more-efficient co-ordination of GPRS and non-GPRS services and functionality: e.g., paging for circuit-switched calls that can be performed more efficiently via the SGSN, and combined GPRS and non-GPRS location updates.

GPRS security functionality is equivalent to the existing GSM security. The SGSN performs authentication and cipher setting procedures based on the same algorithms, keys, and criteria as in existing GSM. GPRS uses a ciphering algorithm optimised for packet data transmission. A GPRS ME can access the GPRS services with SIMs that are not GPRS-aware, and with GPRS-aware SIMs.

Cell selection may be performed autonomously by an MS, or the base station system instructs the MS to select a certain cell. The MS informs the network when it re-selects another cell or group of cells known as a routeing area.

In order to access the GPRS services, an MS shall first make its presence known to the network by performing a GPRS attach. This operation establishes a logical link between the MS and the SGSN, and makes the MS available for SMS over GPRS, paging via SGSN, and notification of incoming GPRS data.

In order to send and receive GPRS data, the MS shall activate the packet data address that it wants to use. This operation makes the MS known in the corresponding GGSN, and interworking with external data networks can commence.

User data is transferred transparently between the MS and the external data networks with a method known as encapsulation and tunnelling: data packets are equipped with GPRS-specific protocol information and transferred between the MS and GGSN. This transparent transfer method lessens the requirement for the GPRS PLMN to interpret external data protocols, and it enables easy introduction of additional interworking protocols in the future. User data can be compressed and protected with retransmission protocols for efficiency and reliability.