SLOVENSKI STANDARD
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Digitalni celiļ ni telekomunikacijski sistem (faza 2+) ï Sploġna radijska storitev s paketiranimi podatki (GPRS) ï Protokol tuneliranja v GPRS (GTP) prek vmesnika Gn in Gp (GSM 09.60, razliļ ica 7.3.1, izdaja 1998)

Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface (GSM 09.60 version 7.3.1 Release 1998)

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Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface (GSM 09.60 version 7.3.1 Release 1998)

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Foreword

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

The present document defines the Gn and Gp interfaces for the 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 by ETSI with an identifying change of release date and an increase in version number as follows:

Version 7.x.y

where:

7 indicates Release 1998 of GSM Phase 2+.

x the second digit is incremented for all 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.

National transposition dates	
Date of adoption of this EN:	19 May 2000
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1 Scope

The present document defines the Gn and Gp interfaces for the General Packet Radio Service (GPRS).

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 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).

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

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

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

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

[5] GSM 03.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 2".

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

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

[8] GSM 04.64: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) Layer Specification".

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

[10] STD 0005: "Internet Protocol", J. Postel.

[11] STD 0006: "User Datagram Protocol", J. Postel.

[12] STD 0007: "Transmission Control Protocol", J. Postel.

[13] RFC 1700: "Assigned Numbers", J. Reynolds and J. Postel.

[14] RFC 2181: "Clarifications to the DNS Specification", R. Elz and R. Bush.

[15] ITU-T 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".

[16] ITU-T Recommendation X.121: "International Numbering Plan for Public Data Networks".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

Conditional: when the presence requirement for the information element is conditional, the receiving protocol level can check the presence or absence of an IE based on the received information.

G-PDU: T-PDU plus a GTP header. A G-PDU is sent in a path.

GTP-Flow: GTP flow is defined by the unidirectional virtual aggregation of G-PDUs and/or signalling messages related to one or more GTP tunnels. A GTP flow is identified by a Flow Label included in the GTP header. The meaning of the Flow Label is transparent for the transmitter side, only the receiver may evaluate the Flow Label.

GTP tunnel: GTP tunnel is defined by two associated PDP Contexts in different GSN nodes and is identified with a Tunnel ID. A GTP tunnel is necessary to forward packets between an external packet data network and a MS user.

MM Context: information sets held in MS and GSNs for a GPRS subscriber related to mobility management (MM) (please refer to the MM Context Information Element).

MM Context ID: IMSI or equivalent for use in conjunction with Anonymous Access (please refer to section GTP Header).

NSAPI: Network Service Access Point Identifier. An integer value in the range [0; 15], identifying a certain PDP Context. It identifies a PDP context belonging to a specific MM Context ID.

Path: UDP/IP path and TCP/IP path are examples of paths that may be used to multiplex GTP tunnels.

Path Protocol: Path Protocol is the protocol(s) used as a bearer of GTP between GSNs.

PDP: Packet Data Protocol (PDP) is a network protocol used by an external packet data network interfacing to GPRS.

PDP Context: information sets held in MS and GSNs for a PDP address (please refer to the PDP Context Information Element).

Quality of Service: Quality of Service may be applicable for the GPRS backbone if the path media supports it. Separate paths with different priorities may be defined between a GSN pair. However, the possible use of QoS in the GGSN is outside the scope of the GTP specification.

Signalling message: GTP signalling messages are exchanged between GSN pairs in a path. The signalling messages are used to transfer GSN capability information between GSN pairs and to create, update and delete GTP tunnels.

TCP/IP path: TCP/IP path is a reliable connection-oriented path defined by two end-points and an end-point is defined by an IP address and a TCP port number. TCP/IP paths should be used when the T-PDUs are based on connection-oriented protocols, such as the X.25 packet layer protocol.

T-PDU: original packet, for example an IP datagram, from a MS or a network node in an external packet data network. A T-PDU is the payload that is tunnelled in the GTP tunnel.

TID: Tunnel ID (TID) consists of a MM Context ID and a NSAPI.

UDP/IP path: UDP/IP path is a connection-less path defined by two end-points and an end-point is defined by an IP address and a UDP port number. A UDP/IP path carries G-PDUs between GSN nodes related to one or more GTP tunnels. A UDP/IP path should be used when the T-PDUs are based on connection-less protocols, such as IP.

3.2 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04.

For the purposes of the present document, the following additional abbreviations apply:

BB	Backbone Bearer
DF	Don't Fragment
FFS	For Further Study
GTP	GPRS Tunneling Protocol
IANA	Internet Assigned Number Authority
ICMP	Internet Control Message Protocol
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
MTU	Maximum Transmission Unit
QoS	Quality of Service
TID	Tunnel IDentifier
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
Gn interface	Interface between GPRS Support Nodes (GSNs) within a PLMN
Gp interface	Interface between GPRS Support Nodes (GSNs) in different PLMNs

4 General

The present document defines the GPRS Tunnelling Protocol (GTP), i.e. the protocol between GSN nodes in the GPRS backbone network. It includes both the GTP signalling and data transfer procedures. It also lists the messages and information elements used by the GTP based charging protocol GTP', which is described in GSM 12.15.

GTP is defined both for the Gn interface, i.e. the interface between GSNs within a PLMN, and the Gp interface between GSNs in different PLMNs. GTP' is defined for the interface between CDR generating functional network elements and Charging Gateway(s) within a PLMN. Charging Gateway(s) and GTP' protocol are optional, as the Charging Gateway Functionalities may either be located in separate network elements (Charging Gateways), or alternatively be embedded into the CDR generating network elements (GSNs) when the GSN-CGF interface is not necessarily visible outside the network element. These interfaces relevant to GTP are between the grey boxes shown in figure 1.

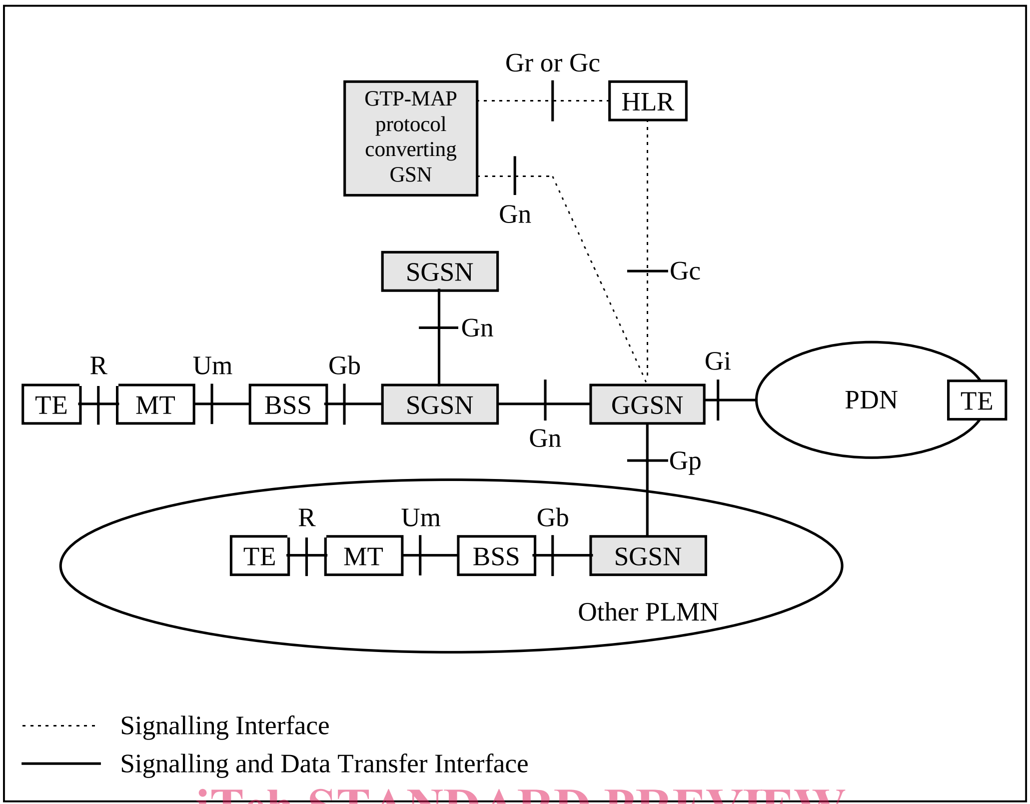


Figure 1: GPRS Logical Architecture with interface name denotations

GTP allows multiprotocol packets to be tunnelled through the GPRS Backbone between GPRS Support Nodes (GSNs).

In the signalling plane, GTP specifies a tunnel control and management protocol which allows the SGSN to provide GPRS network access for a MS. Signalling is used to create, modify and delete tunnels.

In the transmission plane, GTP uses a tunnelling mechanism to provide a service for carrying user data packets. The choice of path is dependent on whether the user data to be tunnelled requires a reliable link or not.

The GTP protocol is implemented only by SGSNs and GGSNs. No other systems need to be aware of GTP. GPRS MSs are connected to a SGSN without being aware of GTP.

It is assumed that there will be a many-to-many relationship between SGSNs and GGSNs. A SGSN may provide service to many GGSNs. A single GGSN may associate with many SGSNs to deliver traffic to a large number of geographically diverse mobile stations.

5 Transmission order and bit definitions

The messages in the present document shall be transmitted in network octet order starting with octet 1.

The most significant bit of an octet in a GTP message is bit 8. If a value in a GTP message spans several octets and nothing else is stated, the most significant bit is bit 8 of the octet with the lowest number.

6 GTP header

The GTP header shall be a fixed format 20-octet header used for all GTP messages.

- Version bits: If the PT bit is '1' (indicating a GTP message), the Version shall be set to 0 to indicate this, the first version of GTP. For the treatment of other versions, see section 10.1.1, "Different GTP versions".

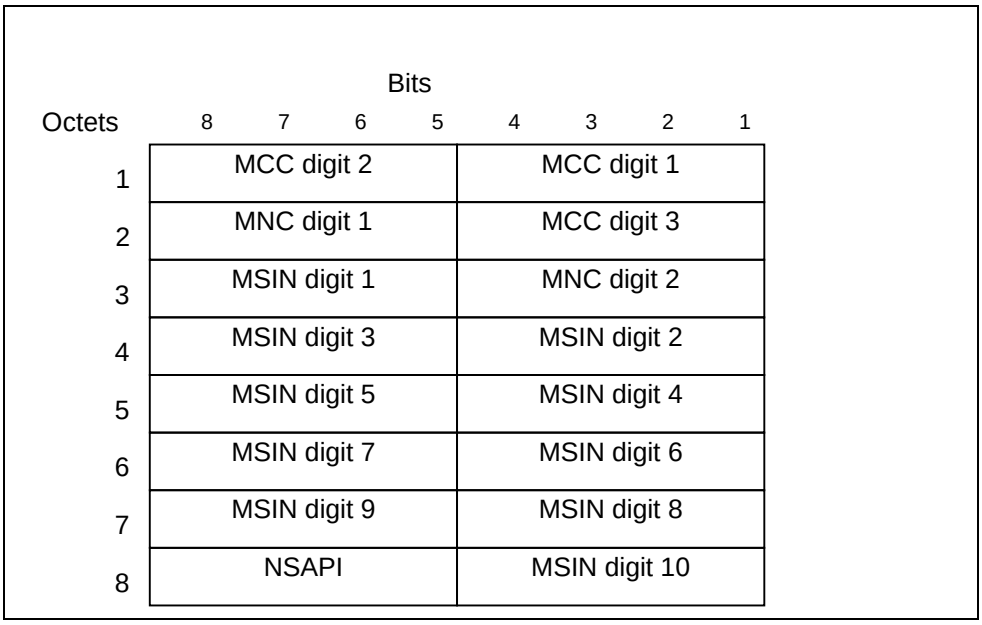
- PT (Protocol Type) bit indicates whether the message is a GTP message (when PT is '1') or a GTP' message (when PT is '0'). GTP is described in the present document and the GTP' protocol in GSM 12.15. Note that the interpretation of the header fields may be different in GTP' than in GTP.
- Spare '1': These unused bits shall be set to '1' by the sending side and shall not be evaluated by the receiving side.
- SNN is a flag indicating if SNDCP N-PDU Number is included or not.
- Message Type indicates the type of GTP message.
- Length indicates the length in octets of the GTP message (G-PDU), excluding the GTP header. Bit 8 of octet 3 is the most significant bit and bit 1 of octet 4 is the least significant bit of the length field.
- Sequence Number is a transaction identity for signalling messages and an increasing sequence number for tunnelled T-PDUs.
- SNDCP N-PDU Number is used at the Inter SGSN Routeing Area Update procedure to co-ordinate the data transmission between the MS and SGSN.
- TID is the tunnel identifier that points out MM and PDP contexts (see Figure 3: Tunnel ID (TID) format).
- The flow label identifies unambiguously a GTP flow.

All fields in the GTP header shall always be present but the content of the fields differs depending on if the header is used for signalling messages (see the sub-section Usage of the GTP Header in the section Signalling Plane) or T-PDUs (see the sub-section Usage of the GTP Header in the section Transmission Plane).

Octets	Bits 8	7	6	5	4	3	2	1
1	Version			PT	Spare ' 1 1 1 '			SNN
2	Message Type							
3-4	Length							
5-6	Sequence Number							
7-8	Flow Label							
9	SNDCP N-PDULLC Number							
10	Spare ' 1 1 1 1 1 1 1 1 '							
11	Spare ' 1 1 1 1 1 1 1 1 '							
12	Spare ' 1 1 1 1 1 1 1 1 '							
13-20	TID							

1) LLC frame number (continued).

Figure 2: Outline of GTP header



NOTE 1: The MCC, MNC and MSIN are parts of the IMSI defined in GSM 03.03. For Anonymous Access, the MSIN shall be replaced by a number assigned by the particular PLMN. The assigned number shall not collide with any MSIN used in the PLMN and shall be unique within the PLMN.
NOTE 2: MSIN digits not used shall be set to F (HEX).

Figure 3: Tunnel ID (TID) format

7 Signalling Plane

The signalling plane in this case relates to GPRS Mobility Management functions like for example GPRS Attach, GPRS Routeing Area Update and Activation of PDP Contexts. The signalling between GSN nodes shall be performed by the GPRS Tunnelling Protocol (GTP).

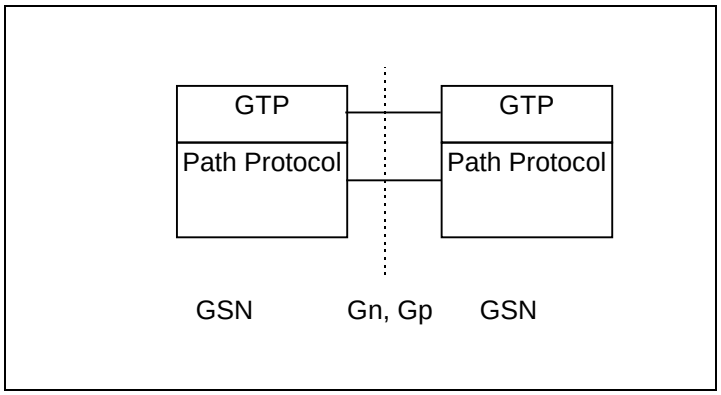


Figure 4: Signalling Plane - Protocol stack

7.1 Signalling protocol

The GTP signalling flow shall be logically associated with, but separate from, the GTP tunnels. For each GSN-GSN pair one or more paths exist. One or more tunnels may use each path. GTP shall be the means by which tunnels are established, used, managed and released. A path may be maintained by keep-alive echo messages. This ensures that a connectivity failure between GSNs can be detected in a timely manner.

7.2 Signalling Message Formats

GTP defines a set of signalling messages between two associated GSNs. The signalling messages to be used are defined in table 1.

Table 1: Signalling messages

Message Type value (Decimal)	Signalling message	Reference
0	For future use. Shall not be sent. If received, shall be treated as an Unknown message.	
1	Echo Request	7.4.1
2	Echo Response	7.4.2
3	Version Not Supported	7.4.3
4	Node Alive Request	GSM 12.15
5	Node Alive Response	GSM 12.15
6	Redirection Request	GSM 12.15
7	Redirection Response	GSM 12.15
8-15	For future use. Shall not be sent. If received, shall be treated as an Unknown message.	
16	Create PDP Context Request	7.5.1
17	Create PDP Context Response	7.5.2
18	Update PDP Context Request	7.5.3
19	Update PDP Context Response	7.5.4
20	Delete PDP Context Request	7.5.5
21	Delete PDP Context Response	7.5.6
22	Create AA PDP Context Request	7.5.7
23	Create AA PDP Context Response	7.5.8
24	Delete AA PDP Context Request	7.5.9
25	Delete AA PDP Context Response	7.5.10
26	Error Indication	7.5.11
27	PDU Notification Request	7.5.12
28	PDU Notification Response	7.5.13
29	PDU Notification Reject Request	7.5.14
30	PDU Notification Reject Response	7.5.15
31	For future use. Shall not be sent. If received, shall be treated as an Unknown message.	
32	Send Routeing Information for GPRS Request	7.6.1
33	Send Routeing Information for GPRS Response	7.6.2
34	Failure Report Request	7.6.3
35	Failure Report Response	7.6.4
36	Note MS GPRS Present Request	7.6.5
37	Note MS GPRS Present Response	7.6.6
38-47	For future use. Shall not be sent. If received, shall be treated as an Unknown message.	
48	Identification Request	7.7.1
49	Identification Response	7.7.2
50	SGSN Context Request	7.7.3
51	SGSN Context Response	7.7.4
52	SGSN Context Acknowledge	7.7.5
53-239	For future use. Shall not be sent. If received, shall be treated as an Unknown message.	
240	Data Record Transfer Request	GSM 12.15
241	Data Record Transfer Response	GSM 12.15
242-254	For future use. Shall not be sent. If received, shall be treated as an Unknown message.	
255	T-PDU	8.1.1