Digital Video Broadcasting (DVB);

Interactive channel through the General Packet Radio System (GPRS)

DVB Document A073 rev. 1

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Contents

1 Scope

The present document is the baseline specification for the provision of an interactive channel based on the General Packet Radio System (GPRS) to support Digital Video Broadcast (DVB) systems.

The DVB project does not intend to specify an interactive channel solution associated with each broadcast system because these broadcast systems should maintain interoperability with different return channel technologies. Therefore, the GPRS solution for the interactive channel applies to satellite, cable, MATV, SMATV, terrestrial, microwave, or any future DVB broadcasting or distribution system.

The solutions provided in the present document for an interactive channel using GPRS are part of a broader set of alternatives to implement interactive services for DVB systems.

The present document covers both the case where the GPRS module is for instance a GPRS handset connected with or without wire to a DVB terminal, and the case where a GPRS module is embedded into a DVB terminal.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI I-ETS 300 041: "European digital cellular telecommunications system (Phase 1); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01)".

[2] ETSI ETS 300 582: "Digital cellular telecommunications system (Phase 2) (GSM); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01)".

[3] ETSI ETS 300 913: "Digital cellular telecommunications system (Phase 2+) (GSM); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01 version 5.9.1 Release 1996)".

[4] ETSI I-ETS 300 042: "European digital cellular telecommunications system (Phase 1); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (GSM 07.02)".

[5] ETSI ETS 300 583: "European digital cellular telecommunications system (Phase 2); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (GSM 07.02)".

[6] ETSI TS 100 914: "Digital cellular telecommunications system (Phase 2+) (GSM); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (GSM 07.02 version 7.0.1 Release 1998)".

[7] ETSI TS 101 348: "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)".

[8] ANSI/TIA/EIA-232-F-1997: "Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange".

[9] Universal Serial Bus Specification, Revision 1.1, September 23, 1998. http://www.usb.org/developers/docs/usbspec.zip

[10] Universal Serial Bus Specification, Revision 2.0, April 27, 2000.

[11] On-The-Go Supplement to the USB 2.0 Specification, Revision 1.0, December 18, 2001.

[12] Specification of the Bluetooth(TM) System, Specifications Volume 1, Core, Version 1.1, February 22, 2001. https://www.bluetooth.org/foundry/specification/document/Bluetooth_Core_1.1_vol_1

[13] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)".

[14] IEEE Standard 802.11b: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Higher Speed Physical Layer (PHY) Extension in the 2.4 GHz band".

3 Abbreviations

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

APN	Access Point Node
BC	Broadcast Channel
BIM	Broadcast Interface Module
DHCP	Dynamic Host Configuration Protocol
DVB	Digital Video Broadcasting
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GPS	Global Positioning System
GTP-U	GPRS Tunnelling Protocol - User
IC	Interactive Channel
IIM	Interactive Interface Module
IP	Internetworking Protocol
ISDN	Integrated Services Data Network
MATV	Master Antenna Television
MS	Mobile Station
MT	Mobile Terminal
NIU	Network Interface Unit
OTG	On-The-Go
PDN	Packet Data Network
PDP	Packet Data Protocol
PDU	Packet Data Unit
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RADIUS	Remote Authentication Dial-In User Service
SGSN	Serving GPRS Support Node
SMATV	Satellite Master Antenna Television
TA	Terminal Adapter
TAF	Terminal Adaptation Functions
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TID	Tunnel ID
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
USB-OTG	Universal Serial Bus - On-The-Go
UT	User Terminal

4 Reference model

A reference model for the system architecture of narrowband interactive channels in a broadband scenario (asymmetric interactive services) is presented in this clause.

4.1 System model

Figure 1 shows the system model that is to be used within DVB for interactive services. In the system model two channels are established between the service provider and the user:

- Broadcast Channel (BC): A unidirectional broadband BC including video, audio, and data. The BC is established from the service provider to the users. It may include the forward interactive path;
- Interactive Channel (IC): A bi-directional IC is established between the service provider and the user for interactive purposes. It is formed by:
  - return interactive channel (return channel): From the user to the service provider. It is used to make requests to the service provider or to provide message response or acknowledgement. It is a narrowband channel that is also commonly known as return channel;
- forward interactive path: From the service provider to the user. It is used to transport interactive service data or related information in the forward direction from the service provider to the user. It may be embedded in the BC. It is possible that this channel is not required for some simple implementations which utilize the BC for the carriage of forward data to the user.

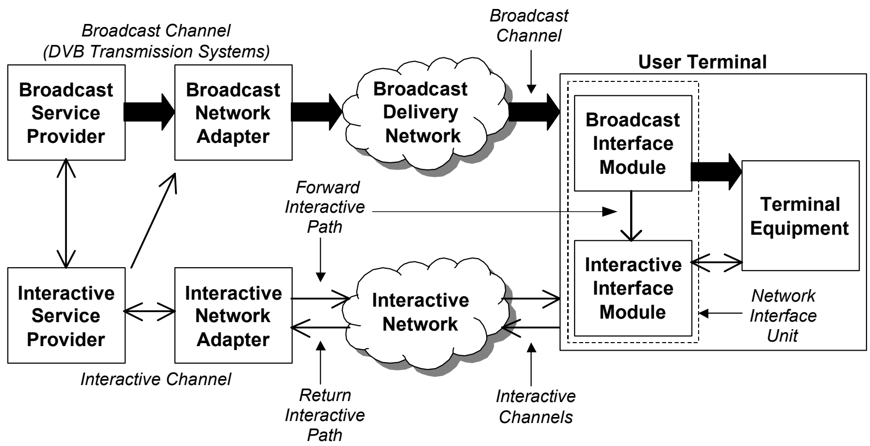

Figure 1: A generic system reference model for interactive systems

The Network Interface Unit (NIU) consists of the Broadcast Interface Module (BIM) and the Interactive Interface Module (IIM). Together, the NIU and the Terminal Equipment (TE) forms the User Terminal (UT). The UT provides interfaces for both broadcast and interactive channels. The interface between the UT and the interactive network is via the IIM.

4.2 Protocol stack model

A simple communication model is used to identify the scope of the present document. The following model consists of different layers (that do not necessarily coincide with the OSI layers):

- physical layer: Where all the physical (electrical) transmission parameters are defined;
- transport layer: Defines all the relevant data structures and communication protocols like data containers, etc;
- application layer: Is the interactive application software and runtime environment.

The present document addresses the two lower layers, leaving the application layer open to market selection. Figure 2 points out the lower layers of the simplified model and identify some of the key parameters.

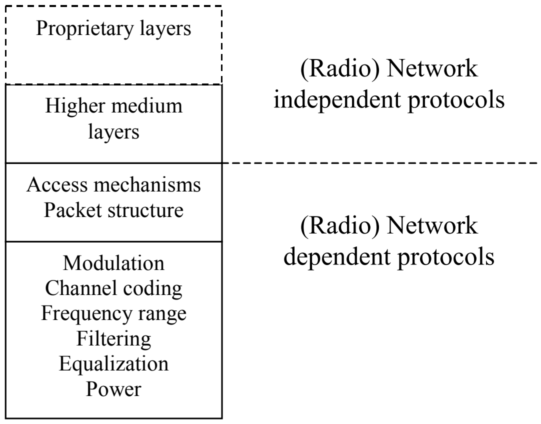

Figure 2: Layer structure for generic system reference model

The present document addresses the GPRS specific aspects only.

A DVB system utilizing GPRS as interactive channel needs further specification on how the radio network independent layers are supported, are dependent on the targeted applications. Figure 3 shows an example of GPRS used in a DVB system for supporting an end-to-end IP infrastructure.

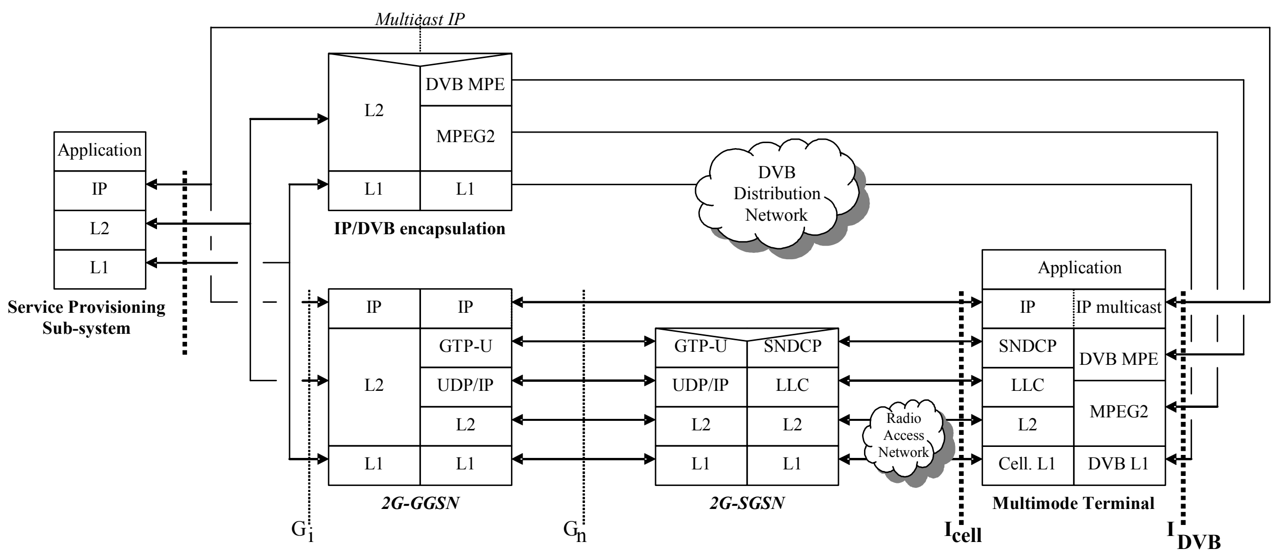

Figure 3: Example of protocol stack architecture involving GPRS as return path for a DVB system carrying IP traffic

5 DVB interactive channel specification for GPRS

A GPRS infrastructure can support the implementation of the interactive channel for DVB broadcasting systems by providing a bi-directional communication path between the user terminal and a system connecting to the service provider.

GPRS is a wireless access technology that can constitute the whole part of the Interactive Network, or it can be utilized for the return path connection only. The GPRS network may be complemented by other networks in order to reach the service provider (PSTN/ISDN, Ethernet).

In order to allow access to the GPRS network, the User Terminal shall be provided with a GPRS Interactive Interface Module, referred to as Mobile Termination (MT). The interface between the MT and the GPRS network shall be compliant with the standard requirements in European digital cellular telecommunications system (Phase 1,2,3); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01,) [1], [2], [3], and European digital cellular telecommunications system (Phase 1, 2 and 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (GSM 07.02) [4], [5],[6].

The interface between the GPRS network and the external network to provide the whole Interactive Channel shall be compliant with the general and signalling requirements on interworking between the Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN) (TS 101 348 [7]) or any other interworking specification.

Depending on the network linking the GPRS network to the service provider, the Mobile Termination should be configured to support the correct bearer capabilities. In the annex B, the interworking functions for IP networks are described for information purposes.

The basic characteristics of GPRS are described in annex A.

5.1 Physical interfaces

At the time of writing, the technologies referenced in this clause represented the most relevant options.

5.1.1 External MT

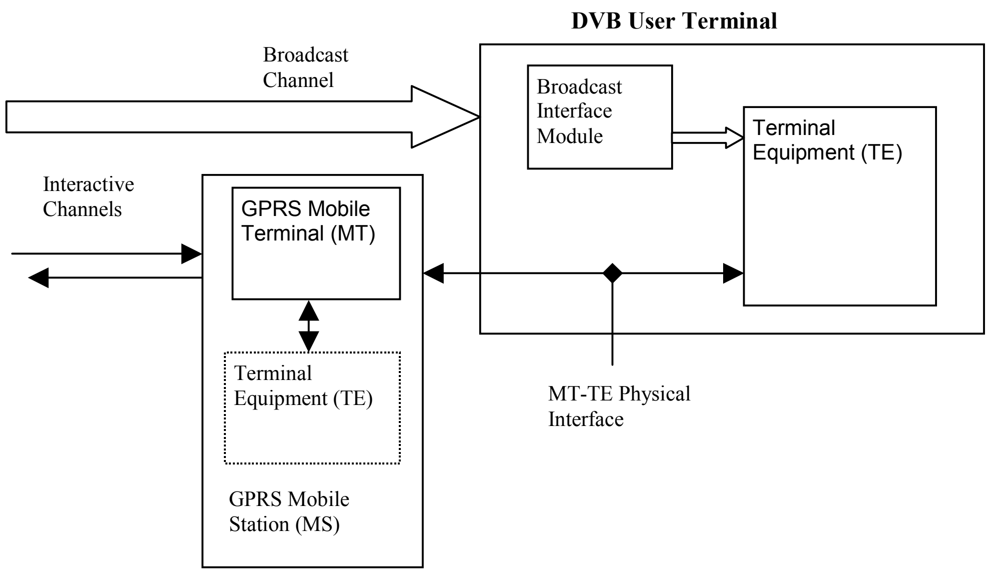

Figure 4: Different Implementation possibilities for External MT

The set-up in figure 4 illustrates at least two implementation possibilities. The first one contains one TE already in the GPRS Mobile Station (MS), and behind the MT-TE physical interface is the second TE inside the DVB User Terminal. Another approach could be that the GPRS MS contains only the MT and the only TE in the device set-up would be inside the DVB User Terminal. In both cases, the external MT from the DVB User Terminal's point-of-view is considered. The MT-TE physical interface in question can be consisted of either wired or wireless connection.

5.1.1.1 Wired connection

In the case of wired connection, three standards, ANSI/TIA/EIA-232-F-1997 (RS-232) [8], USB [9], [10], [11], and PCMCIA are preferred connection standards, though other connection techniques are possible. The mechanical connector in the Mobile Station could be proprietary, at least for the RS-232 case. The preferred USB connection should fulfil the USB 2.0 specification [10] and be compliant with the USB-On-The-Go (USB-OTG) specification [11]. It should be noted that any device with OTG features is first and foremost a USB peripheral that is compliant with USB 2.0 [10] specification.

5.1.1.1.1 RS232/EIA232E: Common interface standard for data communications equipment

In the early 1960s, a standards committee, today known as the Electronic Industries Association, developed the RS-232 common interface standard for data communications equipment, specifying signal voltages, signal timing, signal function, a protocol for information exchange and mechanical connectors.

Thus the simplest wired solution has been via RS232, a serial cable connection between the MT and the rest of the Terminal Equipment (TE). Until recently this was the method of choice for mobile data communications between laptop computers and GSM-GPRS mobile phones.

5.1.1.1.2 Personal Computer Memory Card International Association, PCMCIA standard.

In pursuit of an industry standard, the Personal Computer Memory Card International Association (PCMCIA) was formed by several card manufacturers in the late 1980s to define the card's physical design, computer socket design, electrical interface, and associated software for RAM memory, pre-programmed ROM cards, modems, sound cards, floppy disk controllers, hard drives, CD ROM and SCSI controllers, Global Positioning System (GPS) cards, data acquisition, LAN cards, pagers, etc.

At the start of 2002 the first PCMCIA GPRS devices appeared on the market. There are now dozens of such cards available and they provide a simple unobtrusive GPRS connection for laptops and PDAs.

5.1.1.1.3 Universal Serial Bus USB 2.0 standard

The Universal Serial Bus has been developed by a consortium of computer and equipment manufacturers to provide a high speed serial data connection between a computer and its peripherals. The MT can connect via USB at rates from 12 Mbit/s to 480 Mbit/s to a Terminal Adapter (TA) to provide the data formatting, media conversion and protocol capabilities to contribute to the host application.

5.1.1.2 Wireless connection

In addition to a serial wired connection, many GPRS mobile phones and PDAs offer some kind of wireless connection to the MT. Often this will be an infra-red link, as used in many earlier GSM devices. Increasingly common is Bluetooth(TM) connectivity, which is already used in some cases to link the device headset and transceiver module. Bluetooth(TM) can also be used between the TE and MT.

5.1.1.2.1 Infra-Red (IR) link

The Infrared Data Association (IrDA) is a trade association defining IR data interconnection standards. IrDA Control is an infrared communication standard that allows cordless peripherals such as GPRS handsets to interact with many types of intelligent host devices. The IrDA Data 1.1 standard supports rates from 9,6 kbit/s to 4 Mbit/s at distances up to 1 m, and uses CRC error control.

5.1.1.2.2 Bluetooth(TM) connection

The Bluetooth(TM) short range cordless connection standard [12] has been developed by a consortium of companies known as the Bluetooth(TM) Specification Interest Group. Bluetooth(TM) uses the unlicensed 2,4 GHz ISM spectrum band, and is complementary to Wi-Fi (see below). It is designed to replace cables between MT, lap tops and other devices within a 10 m range. It can be considered to be a wireless USB connection.

5.1.1.2.3 IEEE Standard 802.11b Wi-Fi connection

The IEEE Standard 802.11b [14] has become the dominant standard for wireless networking and is superseding HomeRF. WiFi shares the unlicensed 2,4 GHz ISM spectrum band with Bluetooth(TM) and other cordless devices, and can transfer local area network data at speeds up to 11 Mbit/s per channel at distances up to 100 m.

5.1.2 Integrated MT

The case for the integrated GPRS MT is shown in figure 5. Here the internal interface between Mobile Terminal (MT) and the Terminal Equipment (TE) can be decided and implemented as a proprietary interface in order to optimize the architecture, cost and implementation of the User Terminal.

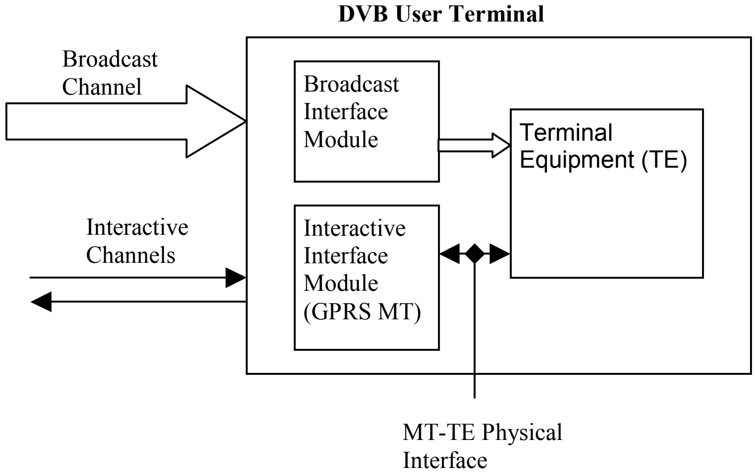

Figure 5: GPRS Return Channel with Integrated MS

As a recommendation can be stated that also the internal interface should be implemented with standard interfaces, if this is possible within size and cost constraints. There are a number of options for a converged terminal with integrated MT. The level of integration can range from:

- PC-type pluggable (mini-) PCI device;
- the addition of a GPRS IC to the mainboard (PCI or other bus architecture);
- the implementation of a combined GPRS/DVB integrated circuit.

5.2 Calling procedures

5.2.1 Terminal Equipment/Mobile Termination connection

The link between TE and MT is based on Point-to-Point Protocol (PPP) [13] that allows the TE to communicate with the MT without a specific GPRS module.

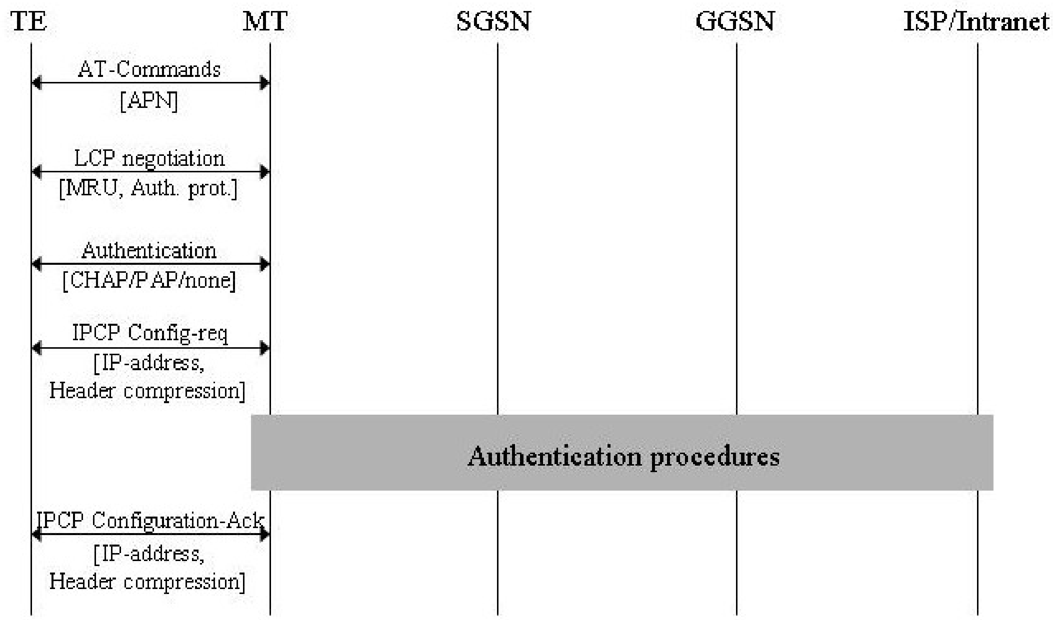

Figure 6: PPP link set-up procedure between Terminal Equipment and Mobile Termination

Using PPP implies that the TE to MT link supports only one IP address. As a result, even if a TE can support more than one IP address, only one is available on the link with the MT, and activation of several PDP contexts with different addresses is currently not supported by R97. Nevertheless, Release 99 (UMTS) specifies the "secondary PDP context" function that allows simultaneous active PDP contexts.

The authentication procedure may exercise a SIM-card-based authentication.

5.2.2 Connection set-up

A GPRS MS can support different types of networks and subscribe to a different QoS class for each data session. Data session characteristics are stored in a PDP context. To be allowed to perform a packet data session, a MS has to be attached to the network (Mobility Management procedures, Attach Request) and has to activate a PDP context. An MS can activate 11 different PDP contexts.

5.2.2.1 MS initiated connection

At PDP Context Activation (see figure 7), the SGSN requests the correct GGSN by using APN information. APN is a logical name referring to the PDN that the subscriber wants to connect to. Then SGSN creates a TID to establish a tunnel with the concerned GGSN. In the case of dynamic allocation in which the GGSN allocates a PDP address to MS; the GGSN may use an address pool, a local or an external DHCP server.

The GGSN stores the PDP context that will be used for routing PDP PDUs between the PDN and SGSN. Finally, the GGSN sends to SGSN the PDP address allocated and other parameters such as the QoS negotiated, charging Id, etc.

The QoS requested by MS may be restricted by the SGSN and GGSN according to their capabilities and current load.

Even if MS is able to activate simultaneous PDP contexts, due to the use of PPP between TE and MT, only one will be available when interworking using an IP network.

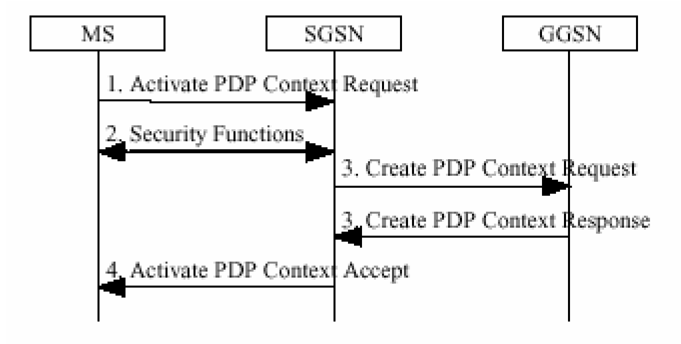

Figure 7: PDP context activation procedure

5.2.2.2 Network initiated connection

Currently, network initiated PDP context activation is not supported.

5.2.2.3 IP Address allocation

The MS may use static or a dynamic address. A static address is provided at subscription while a dynamic address is allocated by the GGSN from an address pool when MS performs the PDP context set-up procedure. Instead of getting an address from the operator internal pool, the GGSN may request an IP address from a DHCP relay. An external operator such as an ISP or Intranet may also operate the DHCP server. An example of MS IP address allocation using local DHCP server is given on figure 8.

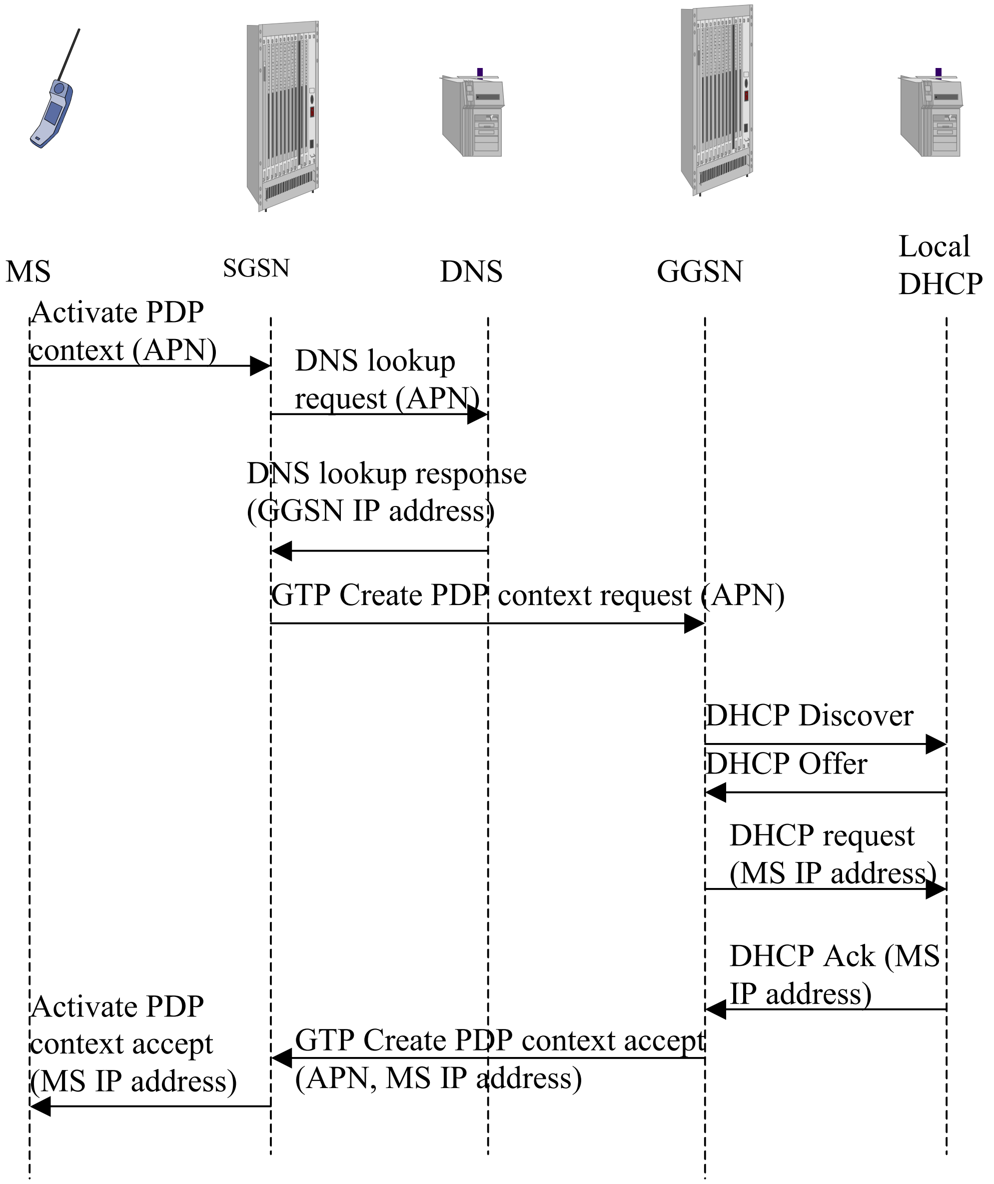

Figure 8: Example of MS IP address dynamic allocation using local DHCP server

The GGSN may also allocate an IP address from an external address provider (intranet's address pool or ISP). In such a case; the GGSN is viewed as a DHCP or RADIUS client. The address and type of the external server are available in the APN profile from the GGSN.

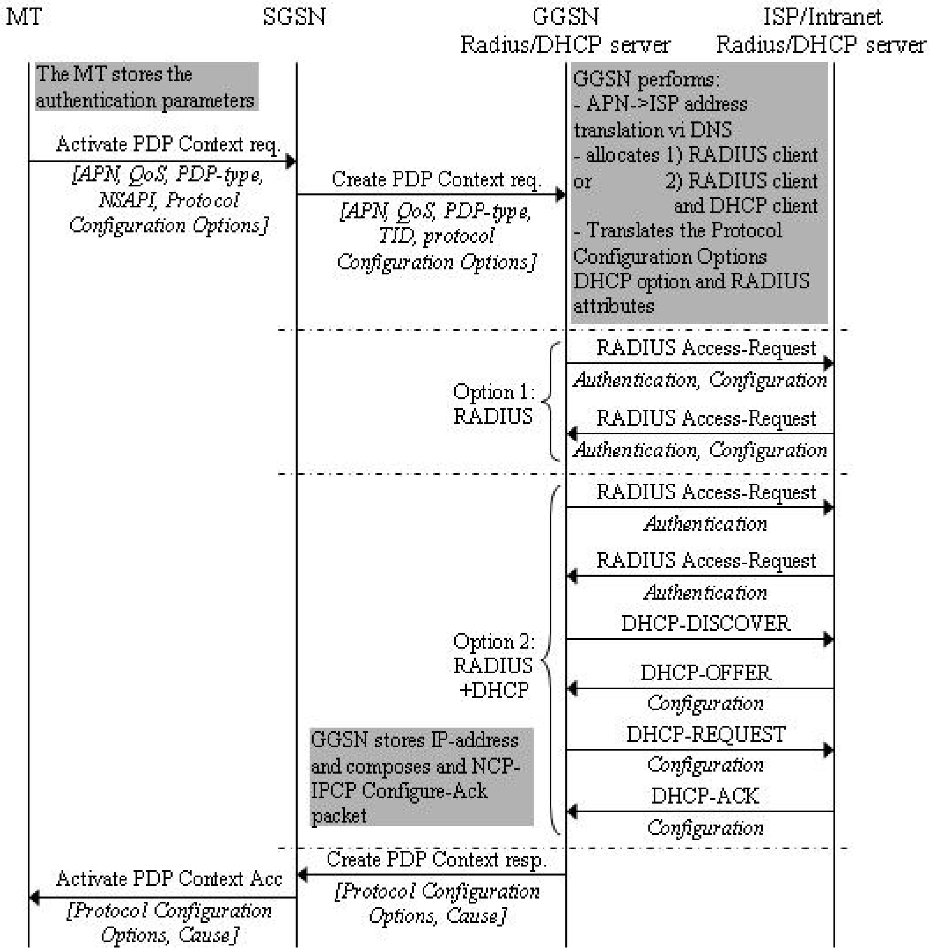

Figure 9: Example of MS IP address dynamic allocation using remote DHCP server

5.2.3 Connection termination

The PDP context deactivation procedure is shown in figure 10.

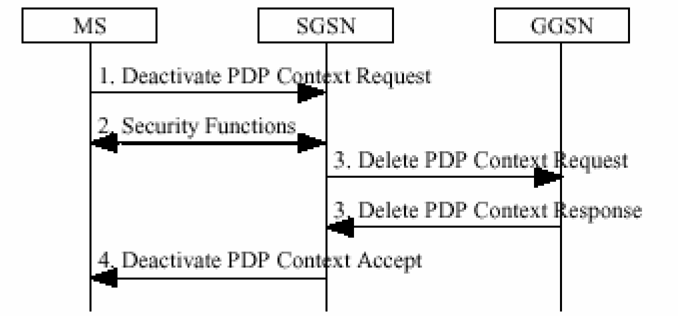

Figure 10: PDP context deactivation procedure

The MS sends a Deactivate PDP Context Request message to the SGSN. The SGSN sends a GTP message to the GGSN to request PDP context deleting. The GGSN removes the PDP context from its table and returns a Delete PDP Context Response message to the SGSN. If the MS was using a dynamic PDP address, the GGSN releases this PDP address.

5.2.4 Known limitations

There may be limitations on what protocols can be used. These are different depending on the operator's network configuration. Consequently it is not possible to include here specific limitations but a list of known possible limitations that need to be checked. Some of these are mentioned earlier in the present document but they are included also in this clause for completeness.

It is recommended that the following points are checked:

- what is the number of allowed simultaneous PDP contexts?
- are static and/or dynamic IP addresses supported?
- does the system operate properly if two users have the same IP address?
- are private and/or public IP addresses supported?
- what problems may the firewall cause?
- is the GPRS return channel "always on" or should the terminal ask for it?
- what GPRS QoS classes are supported?
- what are the capacity/load constraints of the SGSN and GGSN?
- how much capacity there is for GPRS return channel traffic?

These limitations may vary depending on the specification release and on the implementation i.e. on the vendor and the specific product release.

Annex A (normative): Basic characteristics of GPRS

General Packet Radio Service (GPRS) enabled networks offer "always-on", higher capacity, Internet-based content and packet-based data services. This enables services such as colour Internet browsing, e-mail on the move, powerful visual communications, multimedia messages and location-based services.

A.1 GPRS main features

SPEED:

Theoretical maximum speeds of up to 171,2 kilobits per second (kbps) are achievable with GPRS using all eight timeslots at the same time. This is about three times as fast as the data transmission speeds possible over today's fixed telecommunications networks and ten times as fast as current Circuit Switched Data services on GSM networks.

IMMEDIACY:

GPRS facilitates instant connections whereby information can be sent or received immediately as the need arises, subject to radio coverage. No dial-up modem connection is necessary. This is why GPRS users are sometimes referred to be as being "always connected". Immediacy is one of the advantages of GPRS (and SMS) when compared to Circuit Switched Data. High immediacy is a very important feature for time critical applications such as remote credit card authorization where it would be unacceptable to keep the customer waiting.

NEW/BETTER APPLICATIONS:

GPRS facilitates several new applications that have not previously been available over GSM networks due to the limitations in speed of Circuit Switched Data (9,6 kbps) and message length of the Short Message Service (160 characters). GPRS will fully enable many Internet and co-operative applications from web browsing to interacting with broadcast content.

SERVICE ACCESS:

To use GPRS, users specifically need:

- a mobile phone or terminal that supports GPRS;
- a subscription to a mobile telephone network that supports GPRS;
- use of GPRS must be enabled for that user. Automatic access to the GPRS may be allowed by some mobile network operators, others will require a specific opt-in;
- procedures for how to send and/ or receive GPRS information using their specific model of mobile phone, including software and hardware configuration;
- a destination to send or receive information through GPRS. Whereas with SMS this was often another mobile phone, in the case of GPRS, it is likely to be an Internet or IP address.

A.2 Key network features of GPRS

PACKET SWITCHING:

GPRS involves overlaying a packet based air interface on the existing circuit switched GSM network. This gives the user an option to use a packet-based data service.

SPECTRUM EFFICIENCY:

Packet switching means that GPRS radio resources are used only when users are actually sending or receiving data. GPRS improves the peak time capacity of a GSM network since it allocates scarce radio resources more efficiently by supporting virtual connectivity.

INTERNET AWARE:

For the first time, GPRS fully enables Mobile Internet functionality by allowing interworking between the existing Internet and the new GPRS network. Any service that is used over the fixed Internet today - File Transfer Protocol (FTP), web browsing, chat, e-mail, telnet - will be available over the mobile network via GPRS. Because it uses the same protocols, the GPRS network can be viewed as a sub-network of the Internet with GPRS capable mobile phones being viewed as mobile hosts. This means that each GPRS terminal can potentially have its own IP address and will be addressable as such.

SUPPORTS TDMA AND GSM:

It should be noted right that the General Packet Radio Service is not only a service designed to be deployed on mobile networks that are based on the GSM digital mobile phone standard. The IS-136 Time Division Multiple Access (TDMA) standard, popular in North and South America, will also support GPRS. This follows an agreement to follow the same evolution path towards third generation mobile phone networks concluded in early 1999 by the industry associations that support these two network types.

A.3 Limitations of GPRS

LIMITED CELL CAPACITY FOR ALL USERS:

GPRS does impact a network's existing cell capacity. There are only limited radio resources that can be deployed for different uses - use for one purpose precludes simultaneous use for another. For example, GSM voice and GPRS calls both use the same network resources. The extent of the impact depends upon the number of timeslots, if any, that are reserved for exclusive use of GPRS. However, GPRS does dynamically manage channel allocation and allow a reduction in peak time signalling channel loading by sending short messages over GPRS channels instead.

SPEEDS PRACTICALLY LOWER IN REALITY:

Achieving the theoretical maximum GPRS data transmission speed of 172,2 kbps would require a single user taking over all eight timeslots without any error protection. Clearly, it is unlikely that a network operator will allow all timeslots to be used by a single GPRS user. Additionally, the initial GPRS terminals are expected be severely limited - supporting only one, two or three timeslots. The bandwidth available to a GPRS user will therefore be severely limited. As such, the theoretical maximum GPRS speeds should be checked against the reality of constraints in the networks and terminals. The reality is that mobile networks are always likely to have lower data transmission speeds than fixed networks.

A.4 GPRS multislot classes

Multislot classes are product dependant, and determine the maximum achievable data rates in both the uplink and downlink directions.

Written as (for example) 3 + 1 or 2 + 2, the first number indicates the amount of downlink timeslots (what the mobile phone is able to receive from the network).
The second number indicates the amount of uplink timeslots (how many timeslots the mobile phone is able to transmit).

The active slots determine the total number of slots the GPRS device can use simultaneously for both uplink and downlink communications.

Table A.1

Multislot Class	Downlink Slots	Uplink Slots	Active Slots
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5

Further examples:

Table A.2

Class 2	Class 4
One up, Two down - (2 + 1)	**One up, Three down - (3 + 1)**
8 Kbps -12 Kbps Send - 16-24Kbps Receive	8 Kbps -12 Kbps Send - 24-36Kbps Receive
Class 6 - Configurable between	**Class 8**
Two up, Three down	**One up, Four down**
16 Kbps -24 Kbps Send - 24-36Kbps Receive	8 Kbps -12 Kbps Send - 32-40Kbps Receive
Or Three up, Two down	
24 Kbps -36 Kbps Send - 16-24Kbps Receive	
Nokia 6310, 6510, 8310	
Class 10- Configurable between	**Class 12**- Configurable between
One up, Four down	**One up, Four down**
8 Kbps -12 Kbps Send - 32-48Kbps Receive	8 Kbps -12 Kbps Send - 32-48Kbps Receive
Or Two up, Three down	**Or Two up, Three down**
16 Kbps -24 Kbps Send - 24-36Kbps Receive	16 Kbps -24 Kbps Send - 24-36Kbps Receive
	Or Three up, Two down
	24 Kbps -36 Kbps Send - 16-24Kbps Receive
	Or Four up, One down
	32 Kbps -48 Kbps Send - 8-12Kbps Receive

The class indicates the mobile phone capabilities.

Class A:

Class A mobile phones can be connected to both GPRS and GSM services simultaneously.

Class B:

Class B mobile phones can be attached to both GPRS and GSM services, using one service at a time. Class B enables making or receiving a voice call, or sending/receiving an SMS during a GPRS connection. During voice calls or SMS, GPRS services are suspended and then resumed automatically after the call or SMS session has ended.

Class C:

Class C mobile phones are attached to either GPRS or GSM voice service. You need to switch manually between services.

Annex B (normative): Interworking with IP

The GGSN is the access point for interworking between GPRS network and IP networks. From the connected IP network's point of view, the GPRS network is another IP network or sub-network. In other words, from the external IP network's point of view, the GGSN is seen as a normal IP router. Interworking is managed through Gi logical interface which Protocol stack for is given on figure B.1.

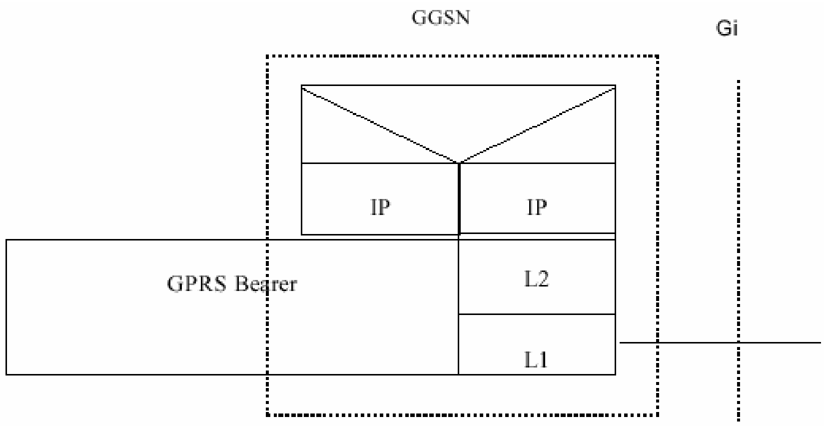

Figure B.1: The protocol stack for the Gi IP reference point

Document History

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