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European digital cellular telecommunications system (Phase 2); Interworking between a Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet switched data transmission services (GSM 09.06)

ETSI

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI).

This ETS identifies the Interworking Functions (IWFs) and requirements for the interworking between a GSM Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet services in GSM PLMNs. This ETS corresponds to GSM technical specification GSM 09.06 version 4.4.1.

The specification from which this ETS has been derived was originally based on CEPT documentation, hence the presentation of this ETS may not be entirely in accordance with the ETSI/PNE rules.

Reference is made within this ETS to GSM-TSs (NOTE).

NOTE: TC-SMG has produced documents which give the technical specifications for the implementation of the European digital cellular telecommunications system. Historically, these documents have been identified as GSM Technical Specifications (GSM-TSs). These TSs may have subsequently become I-ETSs (Phase 1), or ETSs (Phase 2), whilst others may become ETSI Technical Reports (ETRs). GSM-TSs are, for editorial reasons, still referred to in current GSM ETSs.

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1 SCOPE

The purpose of this specification is to identify the Interworking Functions (IWF's) and requirements for the interworking between a GSM PLMN and a PSPDN/ISDN for the support of packet services in GSM PLMNs.

In the GSM PLMN context the packet services are associated with bearer services and are described in GSM 02.02. The generally defined GSM PLMN user-network access as defined in the respective GSM TSs (see references) forms the basis for defining the particularities for the provision of packet services to the GSM PLMN subscribers. Network internal interfaces for the support of packet services in the pan-European ISDN are defined in ETSI standards, which are also taken as a basis.

User-network access and network internal interfaces are defined to provide the packet services.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1]   GSM 01.04 (ETR 100): "European digital cellular telecommunication system (Phase 2); Definitions, abbreviations and acronyms".

[2]   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".

[3]   CCITT Recommendation X.31: "Support of packet mode terminal equipment by an ISDN".

[4]   CCITT Recommendation X.32: "Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for terminals operating in the packet mode and accessing a Packet Switched Telephone Network or an Integrated Services Digital Network or a Circuit Switched Public Data Network".

[5]   ETS 300 007: "Integrated Services Digital Network (ISDN); Support of packet-mode terminal equipment by an ISDN".

[6]   ETS 300 099: "Integrated Services Digital Network (ISDN); Specification of the Packet Handler access point Interface (PHI)".

[7]   ETS 300 102: "Integrated Services Digital Network (ISDN); User-network interface layer 3 Specifications for basic call control".

[8]   ETR 010: "ISDN Standards Management (ISM); The ETSI basic guide onthe European integrated services digital network".

[9]   GSM 02.02 (ETS 300 501): "European digital cellular telecommunication system (Phase 2); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[10]   GSM 02.03 (ETS 300 502): "European digital cellular telecommunication system (Phase 2); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[11]   GSM 02.04 (ETS 300 503): "European digital cellular telecommunication system (Phase 2); General on supplementary services".

[12]   GSM 02.86 (ETS 300 519): "European digital cellular telecommunication system (Phase 2); Advice of charge (AoC) supplementary services - Stage 1".

[13]   GSM 02.88 (ETS 300 520): "European digital cellular telecommunication system (Phase 2); Call Barring (CB) supplementary services - Stage 1".

[14]   GSM 03.03 (ETS 300 523): "European digital cellular telecommunication system (Phase 2); Numbering, addressing and identification".

[15]   GSM 03.10 (ETS 300 528): "European digital cellular telecommunication system (Phase 2); GSM Public Land Mobile Network (PLMN) connection types".

[16]   GSM 03.70 (ETS 300 541): "European digital cellular telecommunication system (Phase 2); Routeing of calls to/from Public Data Networks (PDN)".

[17]   GSM 04.02 (ETS 300 551): "European digital cellular telecommunication system (Phase 2); GSM Public Land Mobile Network (PLMN) access reference configuration".

[18]   GSM 04.08 (ETS 300 557): "European digital cellular telecommunication system (Phase 2); Mobile radio interface layer 3 specification".

[19]   GSM 04.21 (ETS 300 562): "European digital cellular telecommunication system (Phase 2); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[20]   GSM 04.22 (ETS 300 563): "European digital cellular telecommunication system (Phase 2); Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[21]   GSM 07.01 (ETS 300 582): "European digital cellular telecommunication system (Phase 2); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[22]   GSM 07.03 (ETS 300 584): "European digital cellular telecommunication system (Phase 2); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[23]   GSM 08.20 (ETS 300 591): "European digital cellular telecommunication system (Phase 2); Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[24]   GSM 09.03 (ETS 300 600): "European digital cellular telecommunication system (Phase 2); Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN)".

[25]   GSM 09.07 (ETS 300 604): "European digital cellular telecommunication system (Phase 2); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

3   Definitions and abbreviations

Use is made of the following terms within this specification. These terms refer to information requirements necessary to support interworking functions, some of these terms will be identifiable with their use in other specifications.

-       Bearer capability information:

Specific information defining the lower layer characteristics required within the network.

- Lower layer capability information:
  Information defining the lower layer characteristics of the terminal.

- Higher layer capability information:
  Information defining the higher layer characteristics of a teleservice active on the terminal.

- Protocol identifier:
  Information defining the specific protocols utilised for the support of data transfer by a terminal.

- Service profile:
  Set of values of the network default and user selectable attributes selected for a particular DTE identity.

- Loop detection:
  Detection of the situation, where a call, which has left the originating network, re-appears at the originating network.

- GSM packet mode services "Use of X.31 case A":
  A circuit connection shall be used for accessing the packet service (according to ETS 300 099), with the significant characteristics of the connection identified by the following setting of the respective parameters of the Bearer Capability Information Element:
  * information transfer capability = unrestricted digital information
  * transfer mode = circuit mode.
  The issue of "loop detection" is of no concern in the case of X.31 Case A (ETS 300 099) because the PH inserts - irrespective of being accessed by a home or a foreign roaming subscriber - into the "calling address" of an outgoing X.25 "call request" packet the address of the B-channel port.

- Packet mode services via PSTN (X.32):
  A circuit connection shall be used for accessing the packet service with the significant characteristics of the connection identified by the following setting of the respective parameters of the Bearer Capability Information Element in access from a PLMN:
  * information transfer capability = 3.1kHz exPLMN
  * transfer mode = circuit mode.

- Home PLMN:
  That GSM PLMN where the mobile subscriber has his subscription for mobile services.

- Visited PLMN:
  That GSM PLMN on which the mobile subscriber is roamed to when leaving his home PLMN (HPLMN) and logged-in there.

- Basic MSisdn:
  The MSisdn stored in VLR for a visiting mobile subscriber.

- PSPDN port:
  Unit providing incoming/outgoing demand access to a PSPDN (X.32).

| Term | Specification where defined | |
	CCITT, ETS	GSM
Bearer service	I.112, I.210, I.211	02.02
Exchange	I.112	
Terminal Adaptor (Functions)	I.411	07 series
Interworking Function	X.300	09.06,09.07
Attributes	I.112,I.140, I.211	02.01
Connection capabilities	I.340	03.10
Control channel (D/Dm channel)	I.412	04.03
Traffic channel (B/TCH channel)	I.412	04.03
Service profile	ETS 300 099	09.06

Table 1/GSM09.06   Specification reference list

In addition to those below abbreviations used in this specification are listed in GSM 01.04.

AU   Access Unit
Cct   Circuit
CRP   Call Request Packet
IWMSC   MSC accessing the PH

4   INTRODUCTION

General Network Interworking Scenarios are described in GSM 09.01.

When two dissimilar networks are required to interwork in order to support a communication between two subscribers, one on each network, a number of functions performing the interworking are required to support the communication. Some of these are related to the differences in signalling and are dealt with in GSM 09.03.

Examples of other aspects of interworking are:

i)   the need of specific packet functions
ii)   the need of modem pools and network-based rate adaptation.

From the mobile subscriber's point of view, there have been defined two types of services within GSM PLMNs:

-       basic packet mode services:
        These services provide access either to the Packet handler(PH) and/or the PSPDN Port to which the individual subscriber is subscribed to.

-       dedicated packet mode services:
        These services provide access to the PH provided by the visited GSM PLMN, i.e. the "real packet world" is entered as soon as possible.

Packet services are provided in the context of this specification by means of the "circuit" transfer mode.

For the purposes of determining the required IWF functionality, it is necessary, however, to consider separately each type of service i.e. the basic and the dedicated packet mode service.

5   NETWORK CHARACTERISTICS

The key characteristics of networks concerned are listed in Table 3/09.06.

5.1   Characteristics of GSM PLMNs

The GSM PLMN is fully defined in the GSM series of specifications.

5.2   Characteristics of PSPDNs

These are defined in the relevant CCITT X series recommendations, such as X.1, X.2, X.10, X.25, and X.75.

5.3   Characteristics of ISDN

These are defined in the CCITT I-series recommendations. The services and standards for the pan-European ISDN are identified in ETR 010.

5.4   Characteristics of the packet service provided by the PH

The packet services supported via the packet handler interface (PHI) are defined in ETS 300 099. Support for both the ISDN X.31 Case A and Case B are specified there.

Characteristics	GSM PLMN	ISDN	PSPDN
User-network interface	Digital	Digital	
User-network signalling	GSM 04.08	I.441/I.451	X.25, X.31, X.32
User-terminal equipment support	MT0, DTE+MT1, DTE+MT2 see GSM 04.02	Digital TE (ISDN NT, TE1 or TE2+TA) see I.441	DTE
Inter-exchange signalling	SS No.7 ISUP,TUP+, MAP	SS No.7 ISUP, TUP+ X.75	Proprietary, X.75
Transmission facilities	Digital	Digital	Digital
Exchange types	Digital	Digital	Digital
Information transfer mode	Circuit	Cct or Packet	
Information transfer capabilities	Speech, unrestr.digital, altern. speech/ fax group 3, etc.	Speech, unrestr.digital 3.1kHz audio video, etc.	unrestr.digital

Table 3/GSM09.06   Key characteristics of networks concerned

5.5   Characteristics of the packet service provided by a PH assuming the role of an AU or by X.32

The packet services provided by the PH assuming the role of an AU is defined in the ETS 300 099 (X.31 Case A). The packet service provided via a modem is defined in CCITT X.32.

6   INTERWORKING CLASSIFICATIONS

Generally the distinction is made between the service interworking and the network interworking.

6.1   Service interworking

Service interworking is required when the Teleservices at the calling and called terminals are different (e.g. Teletex interworking with facsimile). These aspects are not dealt with in this specification.

6.2   Network interworking

Network interworking is required whenever a GSM PLMN and a non-GSM PLMN together are involved to provide an end to end connection and may be required in instances of GSM PLMN to GSM PLMN connections. The first case applies to the subject matter of this specification and thus dealt with herein after.

7   NETWORK INTERWORKING SCENARIOS

7.1   General

There are two sets of routing scenarios for connecting a GSM PLMN to a PSPDN/ISDN, namely

- via a transit ISDN or PSTN or
- direct connection.

These are identified in GSM 03.70.

What concerns the numbering please see GSM 03.03, GSM 03.70, and ETS 300 099.

7.2   Interworking through transit networks

In this scenario an packet handler or an PSPDN port is considered to be part of the ISDN or the PSPDN, as shown in Figures 1 and 2/GSM09.06.

Figure 1/GSM09.06 shows the access to a conventional X.32 PSPDN port of the PSPDN via transit networks ISDN and/or PSTN. The information transfer capability attribute value indicated in the GSM PLMN is "3.1kHz audio, ex PLMN". In this case, modems are used.

Figure 2/GSM09.06 shows the access to the packet mode service provided according to the concept of the ETSI Packet Handler (PH) with AU functionality as specified in ETS 300 099 section 5 for Case A. The information transfer capability attribute value is "unrestricted digital information". The application of this scenario requires an arrangement with the ISDN operator for granting access to the PH for GSM PLMN subscribers.

The procedures used for mobile originated and mobile terminated calls to establish the circuit connection are defined in sections 8 and 9 for the basic and dedicated packet services, respectively.
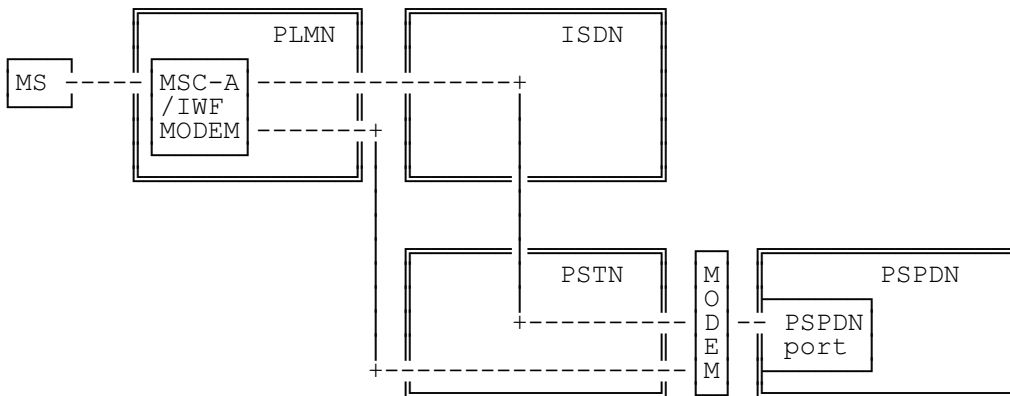
```
      ┌─────────────────────┐   ┌─────────────────────┐
      │  PLMN               │   │         ISDN        │
      │  ┌───────┐          │   │                     │
 ┌────┐│  │MSC-A  │          │   │                     │
 │ MS │├──┤/IWF   ├──────────┼───────────────────+     │
 └────┘│  │MODEM  ├───────+  │   │                 │   │
      │  └───────┘       │  │   │                 │   │
      └─────────────────────┘   └─────────────────────┘
                         │  │                     │
                         │  │   ┌─────────────┐┌─┐ ┌──────────────────┐
                         │  │   │  PSTN       ││M│ │  PSPDN           │
                         │  │   │             ││O│ │                  │
                         │  │   │             ││D│ │  ┌──────────┐    │
                         │  +───┼─────────────┤│E├─┼─│ PSPDN    │    │
                         │      │             ││M│ │ │ port     │    │
                         +──────┼─────────────┤│ │ │ └──────────┘    │
                                └─────────────┘└─┘ └──────────────────┘
```

Figure 1/GSM09.06   Interworking through ISDN and PSTN (3,1kHz exPLMN)

```
      ┌─────────────┐   ┌─────────────┐ PHI ┌──────────────┐
      │  PLMN       │   │  ISDN       │  │  │  PSPDN       │
      │  ┌───────┐  │   │      ┌──┐   │  │  │ ┌──┐         │
 ┌────┐│  │MSC-A  │  │   │      │  │   │  │  │ │PH│         │
 │ MS │├──┤/IWF   ├──────────────────────────┼─┤  │         │
 └────┘│  └───────┘  │   │   ┌─────┐  │  │  │ └──┘         │
      │             │   │   │CRF-P│  │  │  │              │
      └─────────────┘   └───┴─────┴──┘     └──────────────┘
```
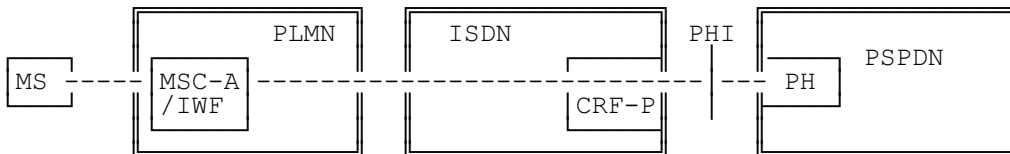
Figure 2/GSM09.06   Interworking through ISDN (unrestricted digital information)

> Note: The packet handler logically is a part of the ISDN.

7.3   Direct Interworking

In this scenario the PH logically is part of the GSM PLMN (Figure 3/GSM09.06) and may be physically located in the GSM PLMN, the PSPDN or the ISDN. In the latter two cases, an arrangement with the PSPDN or ISDN operators is required in order to arrange for GSM PLMN particularities for dedicated access to cope with the "loop detection" issue.

The interface between the MSC and the PH shall be the PH interface (PHI) as specified in ETS 300 099 for Case A. In cases where the available PH only supports the ISDN X.31 Case B, the PH is required to perform a GSM specific function, i.e. to substitute in the X.25 "call request" packet the PH port address in place of a foreign subscribers calling address. The GSM PLMN shall take care of the X.31 Case A/B conversion in order to proceed the call.

```
                  ┌──────────────────────┐
                  │  PHI    PLMN         │
                  │   │   ┌──┐           │              ┌──────────────────┐
 ┌────┐           │┌─────┐│  │           │   │          │  PSPDN           │
 │ MS │───────────┤│MSC  ├┤PH├───────────┼───────────────┤                  │
 └────┘           │└─────┘└──┘           │   │          │                  │
                  │/IWF  │               │              │                  │
                  └──────────────────────┘ X.75 or      └──────────────────┘
                                           propriatory
```

Figure 3/GSM09.06   Direct interworking

Mobile originated and mobile terminated call procedures are defined in sections 8 and 9.

8 BASIC PACKET MODE SERVICE

8.1 General

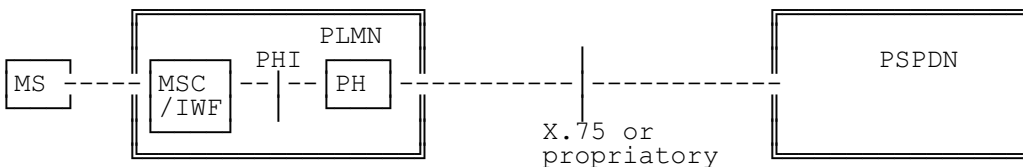Basic packet mode services are the services offered to the mobile users, as described in GSM 02.02, 3x-series. Offering the basic packet mode services requires that GSM PLMNs support the demand access to the PSPDN port in the PSPDN according to CCITT X.32 or to a packet handler of the ISDN (X.31 Case A). See note. This may be either in the network associated with the home PLMN of the respective mobile subscriber or in any other network to which the subscriber is entitled to establish calls.

Note: The Case B is currently not feasible within GSM PLMNs because this case neither allows for addressing of PHs of different providers of packet switched data transmission services nor enables the handling of connections for roaming subscribers. The missing prerequisites for accomplishing this functionality in X.31 Case B are

- for calls from roaming foreign subscribers to the home PH --> support of the according addresses and
- for calls to roaming foreign subscribers via the PH, --> the PSPDN to provide redirection functionality as the gateway of home PLMNs does for routing circuit switched calls for their roaming subscribers.

The scenarios described in section 7 shall apply.

The mobile user may have to subscribe separately to the services offered by the PSPDN port of a PSPDN or by the PH of the ISDN or PSPDN and/or home PLMN, which may depend on the policy or agreements reached between GSM PLMN operator and ISDN or PSPDN operators.

The GSM PLMN networks shall provide only the circuit connection to/from the PH or the PSPDN port. The routing is based on the E.164/E.163 numbering plan because the location of both PH and PSPDN port is identified by E.164/E.163 numbers. Once the connection to the PH or PSPDN port has been established the GSM PLMN is transparent for the user information and in-band control information.

The mobile user shall set in the SETUP message the GSM BC-IE, LLC-IE, and HLC-IE according to GSM 07.01 for 30-series type of services and the applicable variant and shall insert as the called address the E.164/E.163 number associated with the PH or the PSPDN port. That kind of access allows for mobile users to use customized and standard profiles according to CCITT X.32. These profiles are invisible to the GSM PLMNs. The characteristics of the service are those offered via the packet handler interface for X.31 Case A.

The address of the called subscriber for mobile originated calls is sent to the PH or PSPDN port in the "called address" field of the X.25 CALL REQUEST packet and is a number in the format as required by the PH or the PSPDN port. On the basis of this number the PH or the PSPDN port is able to initiate the call establishment to the called subscriber.

8.2 Service provided by the GSM PLMN network

Within the GSM PLMN a subscription to the bearer services BS 32, 33 and/or 34 is required. In order to select the basic packet mode service the mobile subscriber indicates during the call setup the GSM bearer capability IE according to GSM 07.01 "Bearer service 3x; X.32 case" and as the called address the E.164/E.163 address of the PH or the PSPDN port.

The MSC-A shall insert for this type of call the calling party information element containing the Basic MSisdn of the calling mobile subscriber. This information shall be free for being used in conjunction with the calling line identification presentation supplementary service to be performed by the PH, unless the respective GSM PLMN supports the supplementary service Calling Line Identification Restriction and the mobile subscriber wants to apply Calling Line Identification Restriction also to the basic packet mode service. In this case only packet services for unidentified subscribers (see ETS 300 099) would be available to the mobile subscriber.

For roaming subscribers using the basic packet mode services the connection shall be established by the visited PLMN to the PSPDN port or to the PH either in the home country of the respective mobile subscriber or in any other country to which the subscriber is entitled to establish calls, i.e. via an international ISDN/PSTN link.

8.3   Mobile originated calls

8.3.1   Subscriber on home PLMN

This case illustrates a mobile subscriber being in its own GSM PLMN area. The subscriber requires the packet services to be supported by the GSM PLMN network he is subscribed to.

The subscriber requests the appropriate 3x-series service stated in GSM 02.02 by using the BC_IE setting according to GSM 07.01 (restrictions see section 8.7). The SETUP message shall contain the E.164/E.163 address of the PH or PSPDN port.

The MSC-A shall select the appropriate IWF and shall establish a circuit connection to the addressed PH or to the PSPDN port.

8.3.2   Subscriber on visited PLMN

In this case the MSC-A of the VPLMN shall allocate the appropriate interworking functions within the VPLMN, identified from the mobile call set-up request. If the subscriber is accordingly entitled to, the call shall be routed via the visited PLMN's national transit ISDN or PSTN to the PH or PSPDN port identified by the E.164/E.163 ("Dial-in"-case of Figure 4 and 5/GSM09.06). The location of this PH or PSPDN port can be the ISDN or PSTN of the home PLMN or the home PLMN itself or any other ISDN or PSTN. The routing is exactly as for normal data or telephony call addressed to any other subscriber.

In this case the visited PLMN may not have any knowledge that the mobile subscriber requests a packet service and no additional functions are required, to those necessary for a corresponding "data circuit duplex synchronous" (3x-series) service.
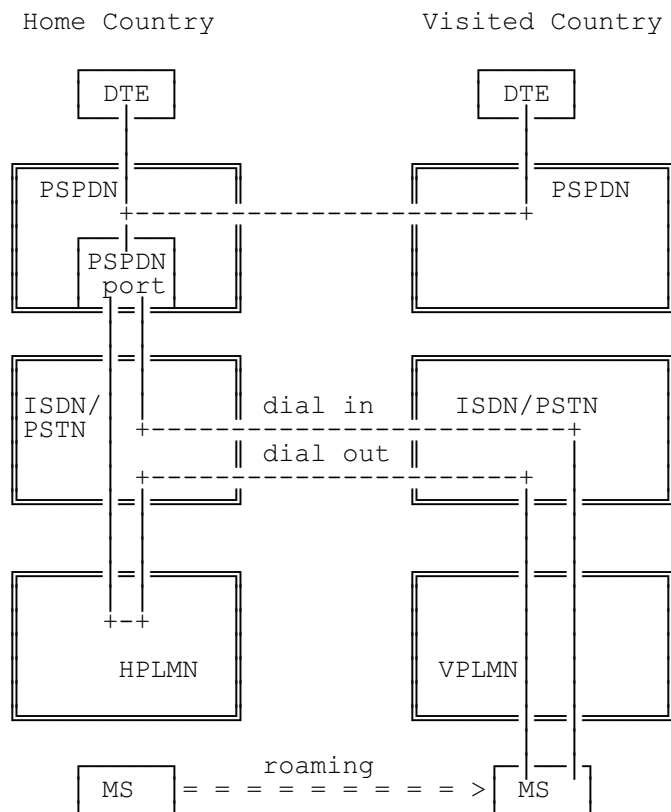
```
        Home Country                 Visited Country

        ┌───────┐                    ┌───────┐
        │  DTE  │                    │  DTE  │
        └───────┘                    └───────┘
        ┌───────────────┐       ┌───────────────┐
        │ PSPDN         │       │        PSPDN  │
        │    +──────────────────────────+       │
        │ ┌───────┐     │       │               │
        │ │ PSPDN │     │       │               │
        │ │ port  │     │       │               │
        │ └───────┘     │       │               │
        └───────────────┘       └───────────────┘

        ┌───────────────┐       ┌───────────────┐
        │ ISDN/         │       │  ISDN/PSTN    │
        │ PSTN    dial in│      │               │
        │    +───────────────────────────+      │
        │    ║ dial out ║               ║       │
        │    +───────────────────────────+      │
        │               │       │               │
        └───────────────┘       └───────────────┘

        ┌───────────────┐       ┌───────────────┐
        │               │       │               │
        │ +─+           │       │               │
        │ HPLMN         │       │  VPLMN        │
        └───────────────┘       └───────────────┘

                          roaming
        ┌───────┐                    ┌───────┐
        │  MS   │= = = = = = = = = = >│  MS   │
        └───────┘                    └───────┘
```

Figure 4/GSM09.06   VPLMN and ISDN/PSTN transit network; 3,1kHz audio ex PLMN

```
        Home Country                 Visited Country

        ┌───────┐                    ┌───────┐
        │  DTE  │                    │  DTE  │
        └───────┘                    └───────┘
        ┌───────────────┐       ┌───────────────┐
        │               │       │               │
        │    +─────────────────────────────+    │
        │ ┌────┐        │       │               │
        │ │ PH │        │       │               │
        │ └────┘        │       │               │
        └───────────────┘       └───────────────┘

        ┌───────────────┐       ┌───────────────┐
        │ ISDN    dial in│      │       ISDN    │
        │    +───────────────────────────+      │
        │    ║ dial out ║               ║       │
        │    +───────────────────────────+      │
        │               │       │               │
        └───────────────┘       └───────────────┘

        ┌───────────────┐       ┌───────────────┐
        │               │       │               │
        │ +─+           │       │               │
        │ HPLMN         │       │  VPLMN        │
        └───────────────┘       └───────────────┘

                          roaming
        ┌───────┐                    ┌───────┐
        │  MS   │= = = = = = = = = = >│  MS   │
        └───────┘                    └───────┘
```
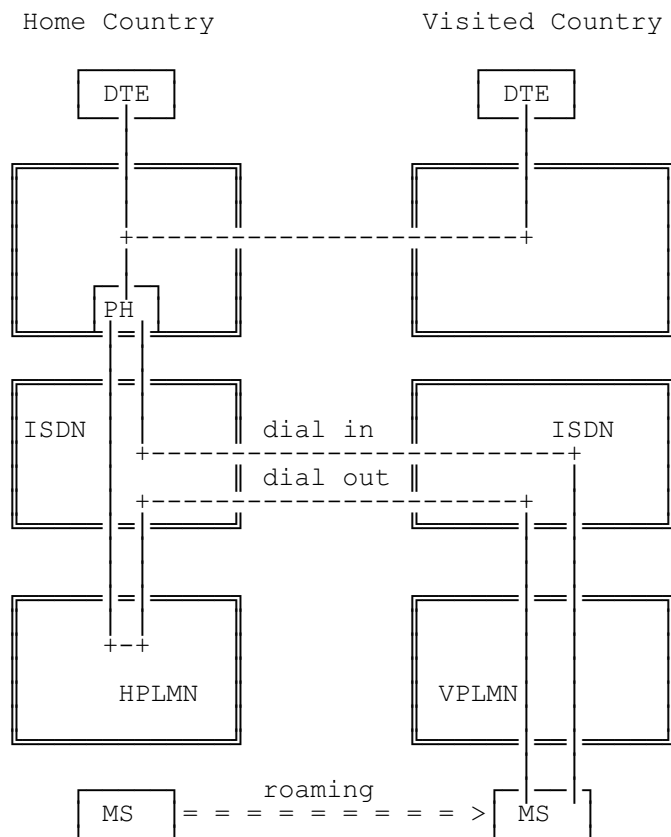
Figure 5/GSM09.06   VPLMN and ISDN transit network; unrestricted digital information

8.4 Mobile terminated calls

8.4.1 Subscriber on home PLMN

The scenarios applicable are those given in Figures 1 to 3/GSM09.06. The PH or PSPDN port translates, if required, the called address received in the X.25 INCOMING CALL packet to the E.164 mobile subscriber number and initiates a circuit connection to be routed firstly through to the GMSC of the home PLMN.

From there on, the call shall be managed in the same manner as any other data call (see GSM 09.07 and 07.03).

8.4.2 Subscriber on visited PLMN

The scenarios applicable are those given in Figure 1 to 3. In this case the call will be handled as for any other data call for roaming home MS (see "Dial out"-case of Figures 4 and 5/GSM09.06).

8.5 Mobile originated mobile terminated calls

The call will be handled for the mobile originated part according to section 8.3 and for the mobile terminated part according to section 8.4. The X.25 packet switching function will be performed in the PSPDN.

8.6 Subscriber profiles

All in-band access identification procedures between the DTE associated with the MS and the PSPDN port or the PH, if applicable, shall be passed "transparently" through the GSM PLMN.

The service profile selection at the PSPDN port or the PH shall be established on the basis of those identification procedures. The subscriber may have a "default", a "standard" or a "customized service profile" according to ETS 300 099/X.32.

8.7 GSM bearer services quality of service

GSM 03.10 identifies the protocol layer structures for both the transparent and the non-transparent mode.

Both transparent and non-transparent mode of operation are applicable to the PSPDN Port scenario identified in Figure 1. For the PH scenario shown in Figure 2 only the non-transparent mode is possible. The scenario shown in Figure 2 assumes a 64 kbit/s service provided via the ISDN and supported by the PH using "X.31 flag stuffing" capabilities. This form of service is not supportable by means of the transparent mode because of the inherent higher throughput rate required, i.e. 64 kbit/s. The non-transparent mode can support this form of service because it is able to remove/add flags and bring the actual "real" throughput rate down/up to one, which GSM and the PH, respectively, can support.

For the transparent mode the GSM PLMN shall provide a synchronous data service with no provision for higher layer capabilities over and above layer 1 (see GSM 09.07 and 07.03).

In case of the non-transparent mode, the call set-up procedures are comparable to those identified above with the exception that the "connection element" in the call set-up message indicates "non-transparent". The receipt of this attribute value causes the MT and the IWF to select the L2R/RLP capabilities (see GSM 07.03 and 09.07). The X.25 data link layer is terminated by the L2R at the MT towards the terminal and reconstituted at the IWF towards the transit network. In case of access to packet handler flag stuffing type of rate adaptation is used between the IWF and the PH. The data link layer parameters to be used at the R and S reference points, respectively, are listed in Table 6/GSM09.06.

The following is applicable for mobile terminated calls:

The IWF will not initiate the establishment of the LAPB link to the PH/PSPDN port, but will wait for an SABM, DM, or DISC, to be able to determine the link layer address to be used. The IWF will use this address until the circuit switched connection to the PH/PSPDN port is released.

XID information received from the mobile station prior to the IWF's LAPB link establishment must either be discarded by the IWF or stored for later transmission if no DM, DISC or XID frames have been received from the fixed network. The first XID frame received (if any) from the PSPDN port prior to LAPB link establishment will be interpreted as a command. The link layer address derived from this first XID will be used for XID information exchange until an SABM, DM or DISC is received.

> Note: This use of LAPB address allows calls from a PH using any of the two alternative address assignment mechanisms defined in CCITT Rec.X.32 and applicable for X.31 case A. In addition, direct interworking of X.25 DTEs (DTE-DTE operation) between an X.25 DTE on a PLMN and an X.25 DTE on a PLMN or ISDN is possible. In this case the DTE address is used instead of the PH address.

The X.25 packet layer information shall be passed transparently from the terminal to the PSPDN.

9   DEDICATED PACKET MODE SERVICE

9.1   General

The "dedicated packet mode service" shall provide to the mobile subscriber the shortest possible connection from the GSM PLMN to the PH for both subscribers staying in the HPLMN as well as for roaming foreign subscribers staying in the VPLMN. Interworking with the PH through the ISDN or directly may be used in the GSM PLMN to satisfy this requirement (see Figures 2, 3, and 6/GSM09.06).

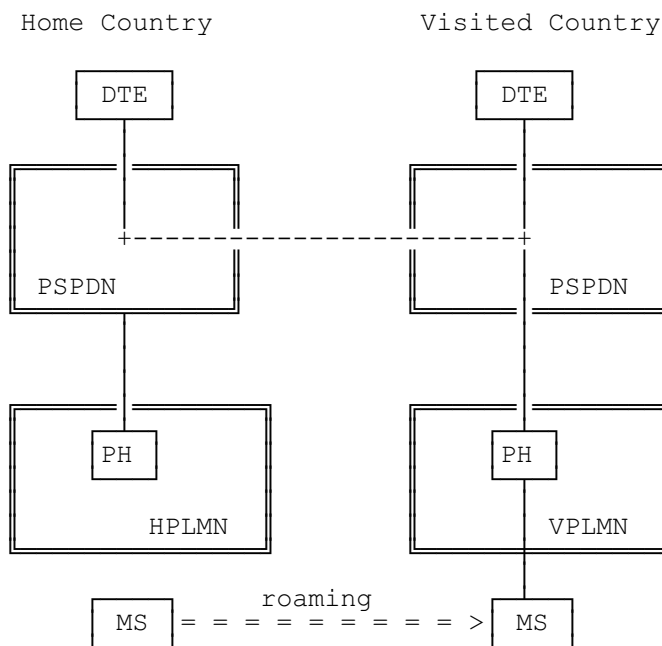Only mobile originated calls are supported.

```
        Home Country            Visited Country

         +-------+                +-------+
         |  DTE  |                |  DTE  |
         +-------+                +-------+
            |                        |
       +----+-----+            +-----+----+
       |          |            |          |
       +----+---------------------+-------+
            |                        |
       |          |            |          |
       | PSPDN    |            |  PSPDN   |
       +----------+            +----------+
            |                        |
       +----------+            +----------+
       |          |            |          |
       | +----+   |            |  +----+  |
       | | PH |   |            |  | PH |  |
       | +----+   |            |  +----+  |
       |          |            |          |
       |    HPLMN |            |    VPLMN |
       +----------+            +----------+

         +------+    roaming       +------+
         |  MS  | = = = = = = = = > |  MS  |
         +------+                   +------+
```

Figure 6/GSM09.06   Dedicated packet mode service; mobile originated call for roaming MS

> Note: The support of mobile terminated calls for roaming subscribers would require the PSPDN to provide redirection functionality at the GMSC of home PLMNs does for routing circuit switched calls for their roaming subscribers. This is currently not the case. Thus the support cannot be provided.

In the dedicated packet mode service, the MT or TA does not use the E.164 address of the PH. A common access procedure as described below shall be applied by all GSM PLMNs supporting this type of service hiding the differences of existing PSPDNs in GSM countries for GSM PLMN subscribers. The mobile subscriber has only a subscription to his HPLMN for the use of packet mode service. The applicable bearer services are those of the 50-series in GSM 02.02. No special E.164 number for addressing the PH or performing the registration with the PSPDN in satisfying the identification needs is necessary for the mobile subscriber in this case.

The advantage of this procedure to the mobile subscriber is that the service offered by the GSM PLMN is completely compatible irrespective of the nature of the packet service in any transit or terminating network, which the GSM PLMN is working to. Additionally the mobile subscriber may receive all billing information for this service, the charges of GSM PLMN and PSPDN from the home GSM PLMN operator/retailer. If this is required, it may be necessary for the GSM PLMN to generate both volume and duration related charging parameters.

User access to the PSPDN at the user/network interface of GSMN PLMN is the same for any type of implementation. Uniform functionality is assumed in the obligatory set-up of the "dedicated packet mode service". Standard procedures are supported over the air interface to support this service.

Concerning the aspects of transparent/non-transparent mode the PH scenario part of section 8.7 - in essence only non-transparent mode - applies.

Three distinct areas of this service - being realized according to the PH interface (X.31 Case A) of the pan-European ISDN - impact upon the overall GSM PLMN interworking requirements:

- general application rules
- specific application rules for this service
- connection establishment procedures for this service.

9.2   General application rules

The dedicated packet mode service supports the X.31 Case A with a default service profile which is applicable for non-registered subscribers. This X.31 Case A default service profile is set up as defined for the the GSM profile in Table 6/GSM09.06.

X.31 Case A customized service profiles are not supported.

Support of the OSI Network Layer Service by this service is a general requirement.

9.3   Specific application of rules for dedicated packet mode service

Particularly, the following rules apply for the PH interface (X.31 Case A) in support of the dedicated packet mode service:

- The calling party number IE of the SETUP message towards the PH is mandatory to provide the PH with the basic MSisdn of the calling mobile subscriber as stored in the VLR. The insertion of the value of the calling party number is an act of the network, thus the PH can take this entry as a verified E.164 number (MSisdn) of the MS.
- The calling party number may be used by the packet handler for charging purposes.
- In cases where the available PH only supports the ISDN X.31 Case B, the PH is required to perform a GSM specific function, i.e. to substitute in the X.25 "call request" packet the PH port address in place of a foreign subscribers calling address.
- There is no need for administration of the DTE identity at the PH because of the MS has only subscription with the PLMN operator.
- Mobile originated calls arriving at the PH shall be accepted as a result of a respective pre-arrangement with the PLMN operator.
- Mobile terminated calls are not supported in its purity according to the dedicated packet mode services. However, the support of mobile terminated calls for home subscribers according to the basic packet mode service may be provided by the same PH equipment, which performs the dedicated packet mode service.

Attribute/parameter	Value
DTE identity	Provided. Verified E.164 number of MS (MSisdn).
Packet sequence numbering	Modulo 8.
Logical channel assignment	n = 2 (outgoing virtual circuits).
Packet length	128 octets.
Window size	2
Fast select and fast select acceptance	Allowed.
Default throughput class	Half of user rate.
Throughput class negotiation	Available.
Transit delay	Negotiable, if applicable (exclusive of inherent GSM PLMN delay budget).
RPOA selection	Provided, if required and supported by the accessed PSPDN.
Link procedure	Single link procedure.
Link Layer Address Assignment	as for LAPB X.25.
Frame sequence numbering	Modulo 8.
Window size	k = 7.
Max. frame length	N1 = 2104 bit.
Retransmission attempts	N2 = 10.
Acknowledge timer	T1 = [3] s (both directions).

Table 6/GSM09.06   GSM profile for layer 3 and layer 2 attributes and parameters, respectively

9.4   Mobile originated calls

9.4.1   General

Within the GSM PLMN a subscription to the bearer services BS 51, 52 and/or 53 is required. In addition either the GSM PLMN or the PH ensures that only calls from subscribers of GSM PLMNs for which roaming agreement exists are progressed. The mobile station indicates in the call set-up the appropriate bearer capability IE according to GSM 07.01 for 50-series Bearer Services.

In the called party number IE of the setup message the following parameters are included to select the dedicated packet mode service:

- Type Of Number (TON) = "dedicated access, short code"
- Numbering Plan Identification (NPI) = "Private Numbering Plan"
- number digits = "short code" (see section 9.4.2)

The connection shall be established in line with GSM 09.07 and 07.03.

The MSC/IWF uses the short code number to select, if applicable, the PH and routes the connection to the appropriate PH.

The interworking function (MSC/IWF) would need to determine the following points:

- User rate from the call set-up request

- Selection of the RLP function and rate for the non-transparent service
- Routing information for PH.

9.4.2 Short code

The value "0000" of the short code is used for the case of one PH operator "visible" to the mobile subscriber and the single GSM profile according to Table 6/GSM09.06, thus serving currently as the "dedicated indicator" only. The individual PLMN operator may arrange for establishing the connections to the PSPDN through networks of different PSPDN operators, but this is currently not at the disposal of the mobile subscribers.

All other values of the short code are reserved for future enhancements, e.g. introduction of a selection procedure for selecting a particular PSPDN operator and/or a particular profile.

9.5 Particular packet access functionality

A number of particular capabilities may be necessary for the support of dedicated packet mode service:

- Charging
  It may be necessary to generate both volume and duration related charging information. This shall be done within the PH.

- Supplementary services interworking
  Interworking of GSM PLMN supplementary services with PSPDN optional user facilities is not provided. The following SS apply: call barring of all outgoing calls and advice of charge. The advice of charge shall be applied for the circuit switched portion only.

History

Document history	
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