



Technical Document - Confidential

**GSM PROTOCOL STACK
SERVICE ACCESS POINT
TRA**

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1.2 Abbreviations

ACI	AT Command Interpreter
AGCH	Access Grant Channel
AT	Attention sequence "AT" to indicate valid commands of the ACI
BCCH	Broadcast Control Channel
BCS	Binary Coded Signals
BS	Base Station
BSIC	Base Station Identification Code
C/R	Command/Response
C1	Path Loss Criterion
C2	Reselection Criterion
CBCH	Cell Broadcast Channel
CBQ	Cell Bar Qualify
CC	Call Control
CCCH	Common Control Channel
CCD	Condat Coder Decoder
CKSN	Ciphering Key Sequence Number
CRC	Cyclic Redundancy Check
DCCH	Dedicated Control Channel
DISC	Disconnect Frame
DL	Data Link Layer
DM	Disconnected Mode Frame
DTX	Discontinuous Transmission
EA	Extension Bit Address Field
EL	Extension Bit Length Field
EMMI	Electrical Man Machine Interface
EOL	End Of Line
F	Final Bit
F&D	Fax and Data Protocol Stack
FACCH	Fast Associated Control Channel
FHO	Forced Handover
GP	Guard Period
GSM	Global System for Mobile Communication
HDLC	High level Data Link Control
HISR	High level Interrupt Service Routine
HPLMN	Home Public Land Mobile Network
I	Information Frame
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
ITU	International Telecommunication Union
IWF	Interworking Function
Kc	Authentication Key
L	Length Indicator
LAI	Location Area Information
LISR	Low level Interrupt Service Routine
LPD	Link Protocol Discriminator
M	More Data Bit
MCC	Mobile Country Code
MM	Mobility Management
MMI	Man Machine Interface
MNC	Mobile Network Code

MS	Mobile Station
MSG	Message phase in the GSM 3.45 protocol
N(R)	Receive Number
N(S)	Send Number
NCC	National Colour Code
NECI	New Establishment Causes included
OTD	Observed Time Difference
P	Poll Bit
P/F	Poll/Final Bit
PCH	Paging Channel
PCO	Point of Control and Observation
PDU	Protocol Description Unit
PL	Physical Layer
PLMN	Public Land Mobile Network
RACH	Random Access Channel
REJ	Reject Frame
RNR	Receive Not Ready Frame
RR	Radio Resource Management
RR	Receive Ready Frame
RTD	Real Time Difference
RTOS	Real Time Operating System
SABM	Set Asynchronous Balanced Mode
SACCH	Slow Associated Control Channel
SAP	Service Access Point
SAPI	Service Access Point Identifier
SDCCH	Slow Dedicated Control Channel
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSCB	Short Message Service Cell Broadcast
SS	Supplementary Services
T.4	CCITT Standardisation for Document coding of Group 3 Facsimile Apparatus
TAP	Test Application Program
TCH	Traffic Channel
TCH/F	Traffic Channel Full Rate
TCH/H	Traffic Channel Half Rate
TDMA	Time Division Multiple Access
TE	Terminal Equipment - e. g. a PC
TMSI	Temporary Mobile Subscriber Identity
UA	Unnumbered Acknowledgement Frame
UI	Unnumbered Information Frame
V(A)	Acknowledgement State Variable
V(R)	Receive State Variable
V(S)	Send State Variable
VPLMN	Visiting Public Land Mobile Network

1.3 Terms

Entity:	Program which executes the functions of a layer
Message:	A message is a data unit which is transferred between the entities of the same layer (peer-to-peer) of the mobile and infrastructure side. Message is used as a synonym to protocol data unit (PDU). A message may contain several information elements.
Primitive:	A primitive is a data unit which is transferred between layers on one component (mobile station or infrastructure). The primitive has an operation code which identifies the primitive and its parameters.
Service Access Point	A Service Access Point is a data interface between two layers on one component (mobile station or infrastructure).

2 Overview

The Protocol Stacks are used to define the functionality of the GSM protocols for interfaces. The GSM specifications are normative when used to describe the functionality of interfaces, but the stacks and the subdivision of protocol layers does not imply or restrict any implementation.

The protocol stack for fax and data transmission consists of several entities. Each entity has one or more service access points, over which the entity provides a service for the upper entity. The entity, which is described in this document, is coloured grey in the following figure :

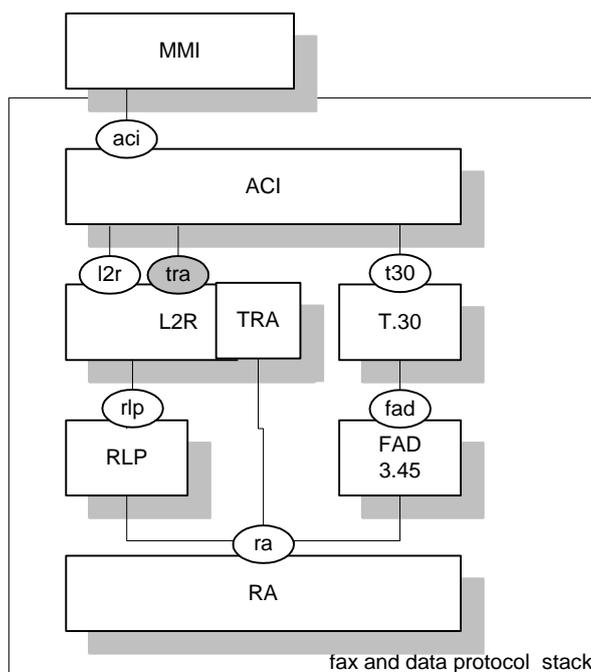


Figure 2-1: Architecture of the fax and data protocol stack

The information units passed via the SAPs are called primitives and consists of an operation code and several parameters. See the Users Guide for details.

The entities of the fax and data protocol stack are:

2.1 RA - Rate Adaptation

This entity performs an adaptation between an asynchronous or synchronous data stream with several bit rates on to the fixed bit rate used at the TCH. This is performed by the rate adaptation functions RA1' and RA0 described in GSM 04.21.

2.2 RLP - Radio Link Protocol

This entity provides a Layer 2 protocol for asynchronous reliable data transfer as specified in GSM 04.22. It includes error correction, sequence numbers and a mechanism for repeating corrupted and lost messages.

2.3 L2R - Layer 2 Relay Functionality

The L2R provides relay functions in order to adapt the character-oriented data received from the TE via USART to the bit-oriented RLP protocol.

2.4 ACI - AT Command Interpreter

The ACI is specified in GSM 07.07. It is responsible for call establishment via the GSM voice protocol stack and terminal adaptation for asynchronous transparent character-oriented data transmission. The ACI is able to receive AT commands and send the replies over the USART driver to a remote PC. This makes it possible to control the voice and data protocol stack from a remote application running on a PC. The ACI also provides a unique interface for an internal MMI in the MS.

2.5 USART - Universal Synchronous Asynchronous Receiver Transmitter Driver

The USART is a hardware component that facilitates a connection between the mobile station and terminal equipment (e.g. a PC). This interface uses some of the circuits described in V.24.

The data exchange provided by this unit is serial and asynchronous (synchronous communication is not in the scope of this document). A driver that uses interrupts to manage a circular buffer for the sending and receiving direction is necessary in order to use this component in the F&D. The driver has to be able to perform flow control.

3 Constants

Definition:

name	value	comment
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History:

28-Mar-00	SLO	Initial
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4 Primitives

4.1 TRA_ACTIVATE_REQ

Description:

The TRA_ACTIVATE_REQ is used to initialise the TRA entity. This is the first primitive, which should be passed to L2R after starting the TRA entity. It contains all parameters necessary for initialisation. Those parameters, which belong to the TRA layer are just passed on to the TRA entity.

Definition:

short name	ID	direction
TRA_ACTIVATE_R EQ	0x8000001 9	ACI-> L2R

Elements:

long name	short name	Ctrl	Ref	Type
-----------	------------	------	-----	------

History:

23 February 98 MG Initial

4.2 TRA_ACTIVATE_CNF

Description:

The TRA_ACTIVATE_CNF acknowledges the previous TRA_ACTIVATE_REQ. The acknowledgement can be positive (ACK) or negative (NAK). It is negative, when the parameters of the TRA_ACTIVATE_REQ are invalid.

Definition:

short name	ID	direction
TRA_ACTIVATE_C NF	0x8000401 9	TRA -> ACI

Elements:

long name	short name	ref	type
acknowledge flag	ack_flg	5.2	UBYT E

History:

22 March 01 MG/SLO Initial

4.3 TRA_DEACTIVATE_REQ

Description:

The TRA_DEACTIVATE_REQ is used to deactivate the TRA entity. This primitive has no parameters.

Definition:

short name	ID	direction
TRA_DEACTIVATE_ REQ	0x8001001 9	ACI-> TRA

Elements:

long name	short name	ref	type
-----------	------------	-----	------

History:
 22 March 01 MG/SLO Initial

4.4 TRA_DEACTIVATE_CNF

Description:
 The TRA_DEACTIVATE_CNF acknowledges the previous TRA_DEACTIVATE_REQ.
 The acknowledge is always positive.

Definition:

short name	ID	direction
TRA_DEACTIVATE_CNF	0x80014019	TRA -> ACI

Elements:

long name	short name	ref	type
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History:
 22 March 01 MG/SLO Initial

4.5 TRA_DTI_REQ

Description:
 TRA_DTI_REQ is used to start data transfer between TRA and another entity via DTI. If this primitive is received the existing DTI connection will be removed and the new connection will be established.

Definition:

Short name	ID	direction
TRA_DTI_REQ	0x80020019	MMI -> TRA

Elements:

long name	short name	Ctrl	ref	type
DTI connect	dti_conn		5.5	UBYTE
Link identifier of DTI	link_id		5.3	ULONG
Communication entity name	entity_name	[TRA_ENTITY_NAME_LEN]	5.1	UBYTE
DTI direction	dti_direction		5.4	UBYTE

History:
 17-Aug-2000 SLO Initial

4.6 TRA_DTI_CNF

Description:

TRA_DTI_CNF is the response primitive to TRA_DTI_REQ.

The primitive does not have parameters.

Definition:

short name	ID	direction
TRA_DTI_CNF	0x8002401 9	UART -> MMI

Elements:

long name	short name	ref	type
DTI connect	dti_conn	5.5	UBYTE
Link identifier	link_id	5.3	ULONG

History:

22 March 01 SLO Initial

4.7 TRA_DTI_IND

Description:

The TRA_DTI_IND is used by TRA to pass the control of the DTI back to the upper layer after detecting the escape sequence (standard: '+++'). The parameter link_id can be used to identify the DTI link.

Definition:

short name	ID	Direction
TRA_DTI_IND	0x8003401 9	TRA -> CTL

Elements:

long name	short name	ref	type
link identifier	link_id	5.3	ULONG

History:

14 October 98 MG Initial
 22 March 01 MG UART replaced by DTI

5 Parameters

Parameters shall be part of the primitives described below and if applied the parameters shall contain the values specified here. These values are selected to correspond element values used in the air interface protocol.

5.1 Entity Name

Description:

This parameter contains a string (zero terminated) which is the name of a neighbour entity, i.e. the entity handling a higher or lower protocol. The parameter is used to open the communication channel to this entity.

Definition:

type	short name	Ctrl	Comment
UBYT E	entity_name	[TRA_ENTITY_NAME_ LEN]	name of an neighbour entity

Values:

value	c-macro	Comment
6	TRA_ENTITY_NAME_ LEN	Max name length

History:

22 March 01 MG/SLO Initial

5.2 Acknowledge Flag

Description:

The parameter identifies the acknowledge flag in response and confirm primitives.

Definition:

type	short name	Comment
UBYT E	ack_flg	acknow ledge flag

Values:

value	c-macro	Comment
0	TRA_ACK	acknow ledged
1	TRA_NAK	not acknow ledged

History:

22 March 01 MG/SLO Initial

5.3 Link Identifier

Description:

This parameter is used to identify the affected channel in case of multiplexing.

Definition:

type	short name	Comment
ULON G	link_id	link identifier

History:

22 March 01 MG/SLO Initial
 10 June 02 TVO Changed to link id

5.4 DTI direction

Description:

This parameter controls if TRA uses the DTI in the normal way or if the primitives are inverted. In the normal way data are sent as DTI_DATA_IND and received as DTI_DATA_REQ. In the inverted mode data are send as DTI_DATA_REQ and received as DTI_DATA_IND (relay functionality).

Definition:

type	short name	Comment
UBYT	dti_direction	DTI direction
E		

Values:

value	c-macro	Comment
0	TRA_DTI_NORM AL	DTI used normally
1	TRA_DTI_INVER TED	DTI is inverted

History:

22 March 01 MG Initial

5.5 DTI connect

Description:

The parameter defines, if TRA shall be connected via the DTI to the upper layer or not.

Definition:

type	short name	Comment
UBYTE	dti_conn	DTI connect

Values:

value	c-macro	Comment
0	TRA_CONNECT_DTI	Connect DTI to TRA
1	TRA_DISCONNECT_D TI	Connect DTI to upper layer

History:

14 October 98 MG Added

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Appendices

A. Acronyms

DS-WCDMA Direct Sequence/Spread Wideband Code Division Multiple Access

B. Glossary

International Mobile Telecommunication 2000 (IMT-2000/ITU-2000) Formerly referred to as FPLMTS (Future Public Land-Mobile Telephone System), this is the ITU's specification/family of standards for 3G. This initiative provides a global infrastructure through both satellite and terrestrial systems, for fixed and mobile phone users. The family of standards is a framework comprising a mix/blend of systems providing global roaming. <URL: <http://www.imt-2000.org/>>