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TETRAPOL Specifications
Part 13: UDT and ST interface;
SubPart 3: STUTEL Profile for the UDT
(*previously released as PAS 0001-13-2)*

Reference

Keywords

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Foreword

This document is the Publicly Available Specification (PAS) of the TETRAPOL land mobile radio system, which shall provide digital narrow band voice, messaging, and data services. Its main objective is to provide specifications dedicated to the more demanding PMR segment: the public safety. These specifications are also applicable to most PMR networks.

This PAS is a multipart document which consists of:

Part 1 General Network Design

Part 2 Radio Air interface

Part 3 Air Interface Protocol

Part 4 Gateway to X.400 MTA

Part 5 Dispatch Centre interface

Part 6 Line Connected Terminal interface

Part 7 Codec

Part 8 Radio conformance tests

Part 9 Air interface protocol conformance tests

Part 10 Inter System Interface

Part 11 Gateway to PABX, ISDN, PDN

Part 12 Network Management Centre interface

Part 13 User Data Terminal to System Terminal interface

Part 14 System Simulator

Part 15 Gateway to External Data Terminal

Part 16 Security

Part 17 Guide to TETRAPOL features

Part 18 Base station to Radioswitch interface

Part 19 Stand Alone Dispatch Position interface

1. Scope

The purpose of this subpart is to describe the interface between the System Terminal (ST) and the User Data Terminal (UDT) at the Data Connection reference Point R1 as defined in PAS 0001-1-1 [1] and PAS 0001-1-2 [2].

This document describes:

- the choices made among the different possible configurations for the STUTEL protocol;
- the behaviour of applications which use STUTEL in the ST and the UDT;
- the transport of Submit/Delivery Protocol (SDP) elements.

The UDT accesses the System messaging services according to Submit/Delivery Protocol (SDP).

The format of STUTEL Protocol Elements makes it possible to set the values of the different parameters chosen.

2. Normative References

This PAS incorporates by dated and undated reference, provisions from other applications. 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 revision of any of these publications apply to this PAS only when incorporated in it by amendment or revision. For undated references the latest edition of publication referred to applies.

[1] PAS 0001-1-1: "Tetrapol Specifications; General Network Design; Reference model".

[2] PAS 0001-1-2: "Tetrapol Specifications; General Network Design; Voice and Data Services in Network and Direct Mode".

[3] ETS 300 075: "Terminal equipment (TE); Processable data File Transfer".

[4] PAS 0001-13-2: "Tetrapol Specifications; UDT and ST interface; Submit/Delivery Protocol".

[5] ITU-T V.24 Recommendations: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit terminating equipment (DCE)".

[6] ITU-T V.28 Recommendations: "Electrical characteristics of asymmetric connector circuits for transmission by double current".

3. Abbreviations

For the purposes of this PAS, the following abbreviations apply:

AMD	Acknowledgement of Message Distribution
AU	Access Unit
BCS	Binary Coded Sequence
BER	ST Transmission/Reception module
BN	Base Network
BNLM	BN Local Messaging
BNOP	Base Network Operator
BS	Base Station
CTS	Clear to send
DCN	Delivery Confirmation Notification
DCP	Data Connection reference Point
DL	Digital link
DSR	Data Set Ready
DT	Data Terminal
DTAU	Data Terminal Access Unit
DTR	Data Terminal Ready
EDT	External Data Terminal
EDT-DCP	EDT Data Connection reference Point
ETP	Extended Transport Protocol
ETSI	European Telecommunications Standards Institute
EXAM	EXternal Application Messaging
FHD	File Header Delimiter
HRSW	Home Radio Switch
IA5	International Alphabet n° 5
IPM	Inter-Personal Messaging
LCT	Line Connected Terminal
LG	Logic Ground
MD	Message Delivery
MHS	Message Handling System
MT	Message Transmission
MTA	Message Transfer Agent
OMC	Operation and Maintenance Computer
OSI	Open System Interconnection
PAS	Publicly Available Specification
PDU	Protocol Data Unit
PE	Protocol Element
PMR	Private Mobile Radiocommunications
PRMD	Private Management Domain
RD	Receive Data
RFSI	Base Network Fleet Grouping Identity
RSW	Radio switch
RT	Radio Terminal
RTA	Radio Transmission Acknowledgement
RTE	Request To Emit
RTP	Reduced Transport Protocol
RTS	Reliable Transfer Server
SCN	Submit Confirmation Notification
SCO	RSW Switching Service
SDP	Submit/Delivery Protocol
SDPE	Submit/Delivery Protocol Element
SFN	Submit Failure Notification
SSW	Secondary Switch
ST	System Terminal
ST-DCP	ST Data Connection reference Point
STUE	UE in the ST
STUTEL	Commercial name of ETS 300 075

TAP	Telesoftware Application Protocol
TAS	Telesoftware Application Service
TPDU	Transport Protocol Data Unit
TPDU_CR	Transport Protocol Data Unit - Connection Request
TPDU_DT	Transport Protocol Data Unit - Data
TTXAU	Teletex Access Unit
UA	User Agent
UDT	User Data Terminal
UDTUE	UE in the UDT
UE	STUTEL protocol User Entity
VRSW	Visited Radio Switch

4. Presentation of the ST-DCP Interface

The hardware and logical interface that connects a User Data Terminal to the System is found in the System Terminal (ST).

The ST, RSW and VRSW shall be "transit points" for exchanges between the UDT and the HRSW.

Local dialogue between the UDT and the shall ST use the STUTEL Extended Transport Protocol (ETP) and Telesoftware Application Protocol (TAP) in ETS 300 075 [3].

In the HRSW the Messaging application shall dialogue with the UDT by using the Submit/Delivery Protocol (SDP) described in PAS 0001-13-1 [4].

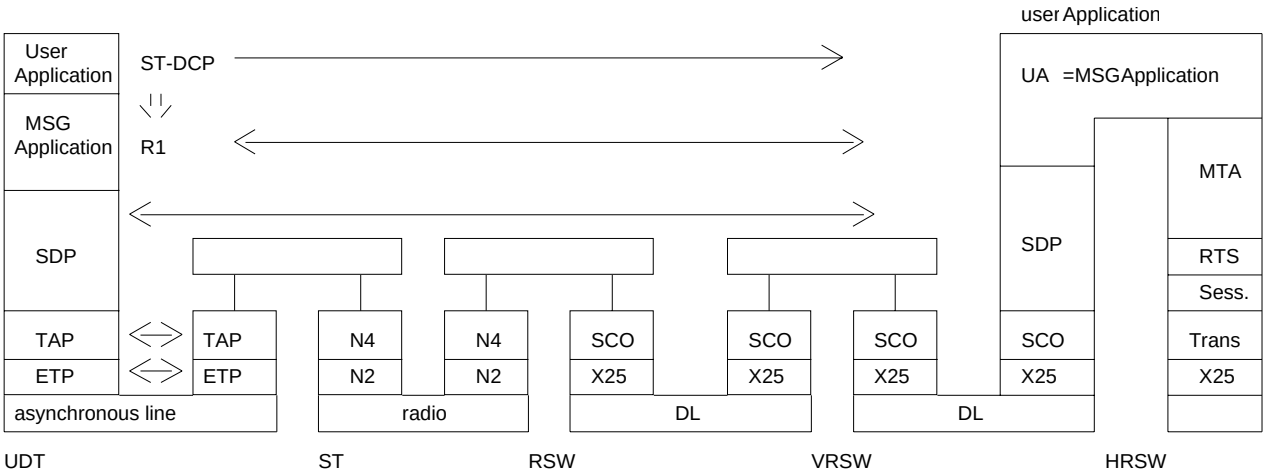

Figure 1: The protocol stacks

Using the ST-DCP, the UDT dialogues with:

- the ST for local management of ST/UDT exchanges, by STUTEL;
- its Home RSW to access IPM and EXAM messaging services, through the Submit/Delivery Protocol (SDP);
- its visited RSW to access BN local messaging services, through the SDP.

5. Physical Layer

The link between the ST and the UDT is line connected. It links the UDT (PC's serial port) to the ST external connector.

The link shall be managed in accordance with ITU-T V.24 Recommendations [5].

The electrical levels shall be those in ITU-T V.28 Recommendations [6].

The cabled signals are:

DT (Data Transmit, 103);

RD (Receive Data, 104);

LG (Logic Ground, 102);

DTR (Data Terminal Ready, 108);

DSR (Data Set Ready, 107);

CTS (Clear to send, 106);

RTE (Request to Emit, 105).

The ST and UDT asynchronous handlers must therefore be designed accordingly:

- monitoring the link is not possible on the physical layer;
- the handler's buffer should be sized to let the traffic flow smoothly. No flow control is carried out by XON/XOFF signals.

Characteristics of the physical link:

- Mode : Asynchronous serial, 1 Start, 1 Stop;
- Parity : 8 bits without parity;
- Code : ASCII (IA5);
- Rate : 4800 bit/s.

The DTR, DSR, CTS signals shall be managed by the UDT. Signals are managed differently according to the kind of terminal (handset or other).

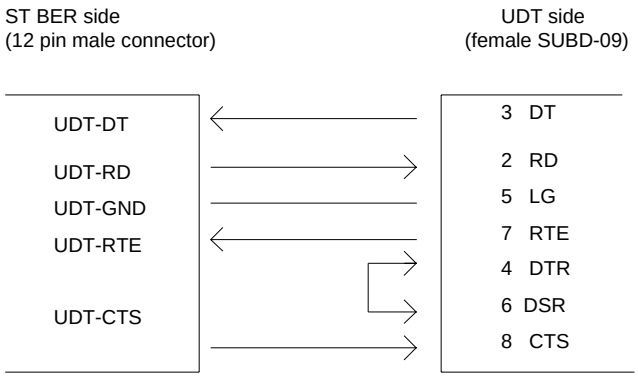

Figure 2: Functional diagram of the ST-UDT link for a handset type ST

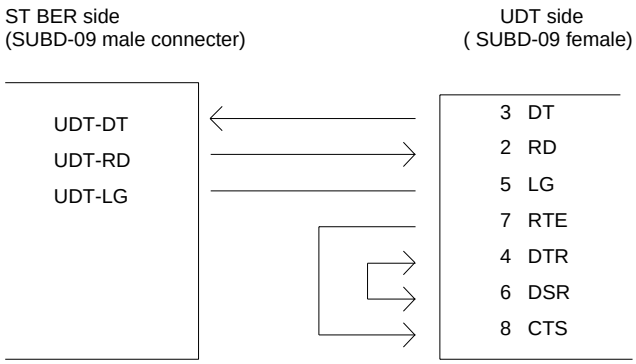

Figure 3: Functional diagram of the ST-UDT link for a mobile or fixed type ST

6. Data link and Network Layers

The functionalities of the data link layer shall be integrated into STUTEL's Extended Transport Protocol (ETP). The link is point to point, layer 3 is not necessary.

7. STUTEL configuration for the ST-UDT Link

STUTEL specifications provide for operations on several network types (X.25, RNIS, Videotex, asynchronous,...). As a result, a large number of services is offered, implementation of which is optional, depending on which link is used for the installation of STUTEL.

STUTEL offers services relating to file transfer and remote directory management.

STUTEL goes beyond the needs of transmitting messages between an ST and a UDT. STUTEL's modularity makes it possible to define a sub-set, which makes up a user profile for the ST-DCP submit/delivery protocol:

- because of ST memory size restrictions, the sub-set defined in this document is only implemented;
- the UDT can be equipped with a STUTEL software with more complete functionalities, which must operate the complete sub-set chosen for the ST. Other STUTEL services are not used for the System operations.

8. STUTEL transport Layer

8.1. Presentation

STUTEL offers two transport profiles:

- The Extended Transport Protocol (ETP), which includes an error detection mechanism (calculation of BCS and data block numbering identical to X.25). ETP is designed to operate in the absence of level 2.
- The Reduced Transport Protocol (RTP) does not include an error detection mechanism, but supposes that such a mechanism is in place in the X.25 layer, above which RTP is installed.

The ST-UDT link is asynchronous line connected. No level 2 is present, the transport protocol is installed directly on the asynchronous handler, which means that the ETP is necessary.

8.2. Services offered by ETP

8.2.1. Error detection

The error detection service must be put into service: the BCS is calculated and the data blocks are numbered.

8.2.2. Transport mode

STUTEL offers five transport modes: A, B, C, D and ETS 300 075 [3].

Mode C is used for the System. In this mode each Protocol Element (PE) is preceded by the binary sequence 1F 3E and ends with the BCS field (coded over 3 octets) followed by the 0D sequence.

A, B, D and E transport modes are not used for ST-UDT link.

8.2.3. Translation mode

STUTEL defines four translation modes:

- mode 1 (no translation);
- mode 2 (3 in 4 coding);
- mode 3 (shift scheme 8-bits);
- mode 4 (shift scheme 7-bits).

These modes are described in ETS 300 075 [3].

Mode 3 is used. It ensures transparency of the characters 1F and 0D (delimiters) when they are present in the body of the PE.

Mode 2 is used to calculate the BCS (see ETS 300 075 [3]).

Translation modes 1 and 4 are not used for ST-UDT link.

8.2.4. Acknowledgement/Confirmation

The mode with acknowledgement and the mode with confirmation are necessary.

8.3. Transport Protocol Elements

All the ETP transport protocol elements are used:

- D-Set-Mode;
- D-Data;
- D-Abort;
- D-Response positive;

- D-Response negative.

9. STUTEL applications Layer

9.1. Presentation

The symmetrical service is put in place for the System, as it has two advantages:

1. Transfers are bi-directional and offer great flexibility in the choice of master and transmitter roles by the Applications.

2. The "typed data" service makes it possible to exchange information (flags or data) between the ST and UDT, outside the message transfer regime.

9.2. Profile of the symmetrical service

The association regime remains permanently established.

The symmetrical service is set up in the ST and in the UDT and can operate either as master or slave.

Access is limited to data transfer operations from the master to the slave (T-Save) and to sending typed data bi-directionally.

Load operations (T-Load) which initiate a transfer from the slave to the master are not necessary. They are nevertheless present to give greater flexibility to the evolution of applications.

Services for reading a directory, changing a file name or deleting a file are not installed in the ST and are not requested by the UDT.

The entity (ST or UDT) which requests establishment of the access regime always assumes the role of master.

Messages with a maximum length of 2kb, recovery mechanisms and for anticipation windows are not necessary: they are not installed in the ST.

9.3. File coding

The System's applications do not use the telesoftware service defined by STUTEL. However, in order to remain in conformity with standard coding, a minimal file structure is used.

The profile adopted only processes text type files, belonging to the A group of accessible files, which is defined in the organisation of the STUTEL telesoftware application (see ETS 300 075 [3]).

For file coding, all the attributes are taken by default:

- File type: text;
- File coding: ASCII;
- no compression.

The header is empty and the file structure is made up of two octets which precede the contents:

- File Header Delimiter (FHD) = $30;
- Header Length = 0.

10. Managing Exchanges between ST and UDT

10.1. Introduction

The STUTEL protocol has a T-Write primitive for message exchange between master and slave entities (establishing a transfer regime by a T-Save).

A T-Typed-Data service makes it possible to transfer information either from the master entity or from the slave entity. The size of information exchanged through this service must not exceed 254 octets (length of user data field).

Information exchanged between the ST and the UDT have an average size of 200 octets (see ETS 300 075 [3]). To optimise exchanges between the ST and the UDT, the typed-data service is used for short messages (less than 254 octets). Messages larger than 254 octets are exchanged using the transfer service (the transmitting entity must have the transmission token).

In this document:

- a short message designates a message with a maximum size of 254 octets;
- a long message designates a message equal or larger than 254 octets.

10.2. General principles

The ST has two memory buffers available to store temporarily a message being transmitted or received.

This mechanism means that a message sent and a message received can cross over in the ST (see Clause "Collision of uplink and downlink messages").

These buffers are managed by the messaging application and are therefore not part of the STUTEL software.

The idle situation corresponds to the master access regime established by the ST.

In these conditions, if the ST receives a message from the radio channel, it is ready to transmit the downlink message, either by using the transmission token for a long message, or by using the typed-data service for a short message. Priority is given to the downlink transfer.

If the UDT has a message to send, it waits - if necessary - for the ST to finish sending its a downlink message.

If the uplink message is a long message the UDT terminates the ST access regime and becomes "master" (the UDT establishes a new access regime then a transfer regime in an uplink direction). If the message is short, the UDT transmits its message using the typed-data service without interrupting the ST’s access regime.

At the end of an uplink transfer which gave rise to the establishment of an access regime by the UDT, the ST terminates the access regime (even if it has no message to transmit). The ST then recovers its "master" role by establishing another access regime.

The ST can transmit a flow of successive downlink messages to the UDT without changing role: either through the typed-data service or by establishing a transfer regime, according to the length of the messages to be sent.

For the UDT, the case is different:

- if the UDT has several short messages to send, it transmits them successively to the ST using the typed-data service;
- if the UDT has long messages to send, it loses its "master" role at the end of transmission of each message and must re-establish an access regime before sending the next message.

If an uplink message is being transferred on the ST-UDT link and a downlink message is sent to the ST, the ST waits for the end of the uplink message before transferring the downlink message to the UDT.

The rules to be applied in case of crossover of an uplink message and a downlink message are described in the Clause on "Collision in the ST".

To summarise, a change of role takes place:

- at the UDT initiative, each time there is a long message to be sent and there is no downlink message currently transferred (no established transfer regime);
- at the ST initiative when the UDT has finished sending a message.

10.3. Transmission token mechanism

Exchanging long messages is subject to the allocation of the master role.

The allocation of master and slave roles is decided by the management of a "transmission token", controlled by the ST and UDT messaging applications.

The transmission token is always in the master's possession. The slave is therefore the receiver. Because of this, the loading function of STUTEL (T-Load) is never used.

The allocation of roles by the ST and UDT applications takes place as follows:

1. The entity (ST or UDT) which requests the establishment of an access regime (T-Access) assumes the role of master and can send its message (T-Save then T-Write).

   A distinction is thus made between:

   - the ST access regime for transferring long downlink messages to the UDT (the ST is in possession of the transmission token),
   - the UDT access regime for transferring long messages to the ST (the UDT is in possession of the transmission token).

2. The idle situation corresponds to the access regime established by the ST (ST master).

3. In accordance with STUTEL, the entity which receives an End-Access indication cannot refuse this request and is therefore obliged to lose the transmission token.

Exchange rules between the ST and the UDT:

1. When the UDT ends the ST access regime, it gives an indication - in the "cause" parameter of T-End-Access - on the priority of the message it is preparing to send.

2. Each request to establish a transfer regime (T-Save), whether established by the ST or the UDT, contains in the "user data" parameter, the priority and the total length of the message to be sent.

3. The UDT refrains from sending a request to abort a transfer operation towards the ST. Remark: The "cause" fields of T-End-Access and the length of T-Save are filled in by the ST and the UDT, but their validity is not checked.

Exchanges between the ST and the UDT that lead to a change in role, then to the establishment of a transfer regime are represented below, at the STUTEL Transport level (ETP).

The ST is master in idle situation; if the UDT wants to send, it changes roles:

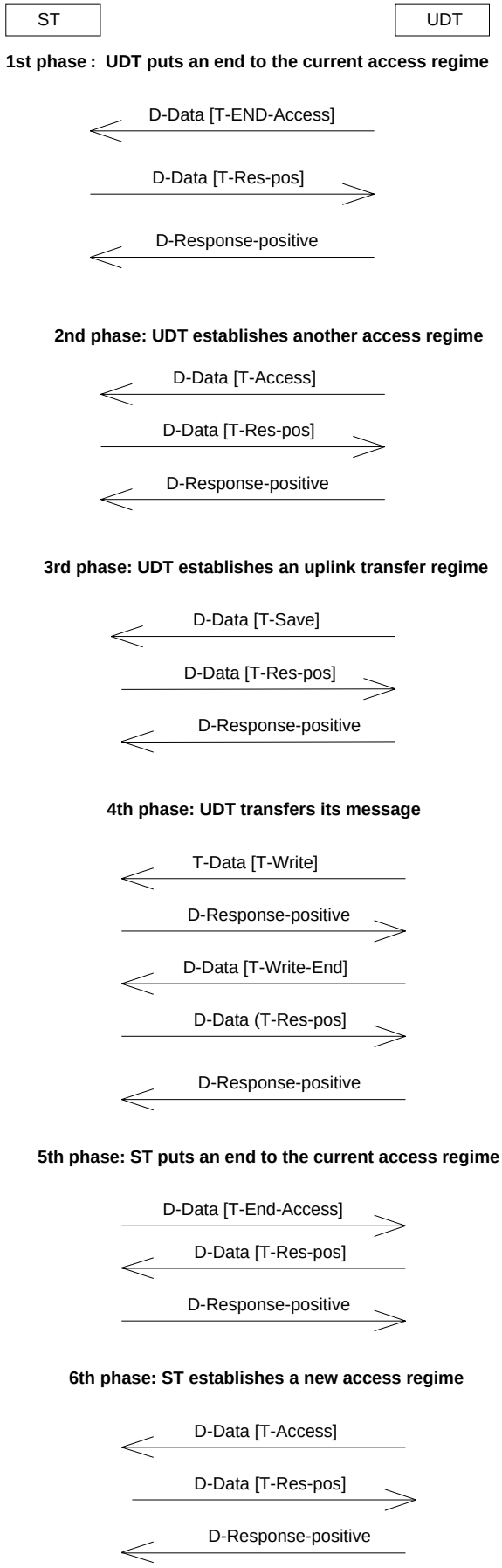

Figure 4: Transmission token protocol

10.4. Typed Data

A short message can be sent by the ST or the UDT without the transfer regime and without possession of the transmission token.

The ST entity is master:

- The ST can transmit the downlink message using the typed data service;
- The UDT can send an uplink message using the typed data service in the idle situation of the access regime (no transfer of data from the ST to the UDT).

The UDT entity is master:

- The ST can transmit a downlink message whilst the UDT is master, the transfer regime must not be established by the UDT.

The access regime is established: ST or UDT as master

The ST wants to send a short downlink message:

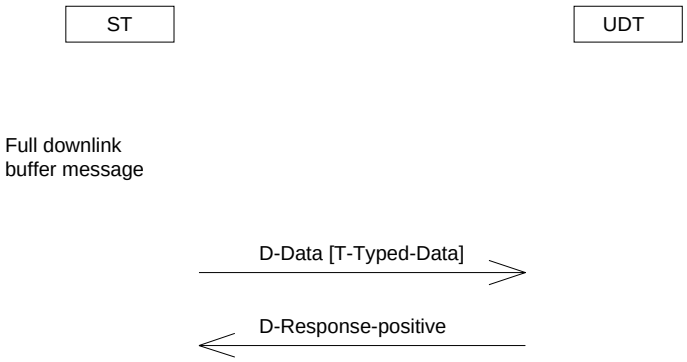

Figure 5: Typed data protocol

Idle situation: the ST is master (access regime established).

The UDT wants to send an short uplink message:

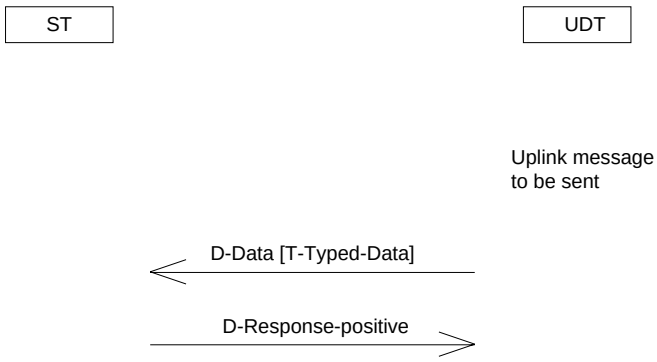

Figure 6: Uplink typed data

11. Internal ST/UDT signalling

STUTEL typed-data are used:

- to exchange internal signalling between ST and UDT;
- to exchange short messages between the ST and the UDT.

In accordance with STUTEL, typed data are sent without a transfer regime, as the access regime has been established.

This Clause describes the use of typed data for signalling. The use of typed data to exchange short messages is explained in the previous Clause.

This dialogue enables the ST to:

- report to the UDT the success or failure of the transmission of a message on the radio channel: positive or negative "Radio Transmission Acknowledgement" (RTA or NRTA);

  failure can be caused by the interruption of the transmission of an uplink message by a downlink message;
- ask the UDT authorisation for non encrypted transmission, in case encryption is impossible;
- monitor the presence of the UDT, which makes it possible to reduce the response time of the ST to a message transmission request, coming from the network (downlink message);
- warn the UDT that the network is in Main Switch Disconnected Fall back mode or return to normal mode or to Inter BN Disconnected mode. This information enables the UDT to know which messaging service it can access (see note);
- indicate to the UDT an information on its localisation (Field "R" of the visited network and cell number);
- indicate to the UDT the network status during ST-UDT connection.

The three types of information (Network Status, Base network number and cell number), can be coded in the same signalling typed data (see Clause Format of STUTEL protocol element).

This dialogue enables the UDT to:

- ask for the sound alarm to be set off and to ask for this alarm to be stopped;

NOTE: In Main Switch Disconnected mode, a group of SSWs is isolated from the HRSW:
Inter-Personal messaging and External Application Messaging are no longer accessible. Only Base Network Local messaging is available in normal, Inter BN Disconnected and Main Switch Disconnected modes.

12. Application Level

12.1. Presentation

STUTEL manages local exchanges between ST and UDT. Dialogue is established above STUTEL:

- between an UDT and the HRSW or VRSW, for access to messaging services, it is the Submit/Delivery Protocol (see PAS 0001-13-2 [4]);
- between an UDT and its ST, for local management of the link: it is internal ST/UDT signalling (see Clause "Internal ST/UDT signalling").

12.2. Submit/Delivery Protocol (SDP)

The dialogue between UDT and HRSW or VRSW is managed at the application level by a Submit/Delivery Protocol (SDP) which makes it possible:

- for the UDT to transmit messages to the HRSW;
- to the HRSW to deliver messages to a UDT.

This protocol is common to the System's different messaging applications (inter-personal, external application and BN local messaging services).

The specification for SDP is in PAS 0001-13-2 [4].

SDP Protocol Elements are linked to a message submission or delivery transaction. The list of SDPEs is given here.

On the ST-DCP interface, SDPEs are carried by one or several STUTEL TAP T-Write protocol elements for long messages and a T-Typed-Data element for short messages.

12.2.1. Message submission transaction

The SDPEs exchanged during the UDT message submission transaction are:

- Message transmission (MT);
- Submit confirmation notification (SCN/SFN);
- Delivery confirmation notification (DCN/DFN).

12.2.1.1. Message transmission (MT)

Sent by a UDT to request a messaging service (carried by one or several T-Writes or T-Typed-Data according to the size of the message to be sent).

After the UDT has sent this SDPE, a local dialogue between the ST and the UDT based on the STUTEL T-Typed-Data PEs takes place (radio acknowledgement and management of the unencrypted message).

This dialogue is not part of the Submit/Delivery Protocol, which is established between the UDT and the RSW.

12.2.1.2. Submit confirmation notification (SCN/SFN)

Sent by an RSW to a UDT, in response to an MT, carried by a T-Typed-Data (the size of a notification is less than the maximum size of a message transmitted by typed data).

12.2.1.3. Delivery confirmation notification (DCN/DFN)

Sent by an RSW to a UDT which has already received an SCN, carried by one or several T-Write (according to the number of recipients concerned by the notification) or by one T-Typed-Data (if few recipients are involved).

The UDT never acknowledges a DCN. The Acknowledgement of Message Distribution (AMD) of the SDP is not therefore used in the ST-DCP.

12.2.2. Message Delivery Transaction

The SDPEs exchanged during the delivery transaction to a UDT are:

- Message delivery (MD);
- Distribution report (DR).

12.2.2.1. Message delivery (MD)

Sent by an HRSW to deliver a message to a UDT (carried by one or several T-Write or a T-Typed-Data according to the size of the message to be transmitted to the UDT).

12.2.2.2. Distribution report (DR)

Sent by an HRSW to the back-up terminal to signal the non reached primary recipients. This report is sent with the message delivery during the back-up distribution (carried by one or several T-Write or a T-Typed-Data according to the size of the report to be transmitted to the UDT).

The UDT never acknowledges message delivery. The Acknowledgement of Message Distribution of the SDP is not therefore used in the ST-DCP.

13. STUTEL User Entities

In the rest of the document the use of the STUTEL TAS in the UDT and the ST is described, for message exchanges with the ST and for using messaging.

The software modules dedicated to this task are designated hereafter respectively by the terms "UDT User Entity' (UDTUE) and 'ST User Entity' (STUE).

UEs offer the following functions:

- establishing connections and initialisation;
- transmission and reception of messages;
- processing collision incidents with down link messages;
- monitoring the link.

The document describes STUTEL error processing and its application to the particular case of the ST-UDT link.

The profiles of Association and Access regimes are fixed. That is, the T-Associate and T-Access protocol elements (PE) carry fixed parameters (in nature and value), which cannot be negotiated. This does not restrict use of the protocol and makes it possible to reduce the time taken to establish regimes.

Parameter values are given in the Clause "Format of STUTEL Protocol Elements".

14. Establishing connection and initialisation

14.1. Presentation

Connection between the ST and the UDT entities is established without the user intervening.

Connection takes place in two steps:

- establishment of the physical connection;

- establishment of the STUTEL connection (Association and Access regimes).

14.2. Principle

Physical connection is made on the initiative of the ST, which periodically emits a poll signal on the asynchronous link (4s period), until the UDT acknowledges this signal.

The poll signal emitted by the ST is formed of two ENQ characters (ASCII code = 05).

At start-up, the UDTUE initialises its asynchronous controller and waits for the poll signal. The UDT ignores all other frames.

On reception of this signal, the UDTUE emits a presence signal which acknowledges the poll signal. The UDTUE shall guarantee it emits the presence signal in a 80ms maximum delay (elapsed time between the reception of the poll signal and the emissions of the presence signal transmission time are insignificant. After this delay, the ST shall ignore the received signals from the UDT and retransmit the poll signal at the 4s elapsed period).

The presence signal emitted by the UDT is made up of a sequence of successive ACK characters (ASCII code = 06).

On reception of the UDT's presence signal, the ST sends a single XOFF character (ASCII code = 19), which is aimed at stopping the UDT emitting its presence signal.

Each UE then proceeds with the local initialisation of STUTEL software:

- The ST establishes the Association regime, then the Access regime. It first assumes the master role and owns the transmission token;
- The request to establish the Association regime is carried out with confirmation (a STUTEL restriction in the symmetrical service), to enable both entities to define their response time out. The ST transmits to the UDT its RFSI address;
- The request to establish the Access regime is carried out with confirmation (a STUTEL restriction in the symmetrical service).

The ST considers that the UDT is present as long as the Association regime remains established.

After establishing the Association regime and the first Access regime, the ST sends the network status to the UDT.

14.3. Protocol elements chain

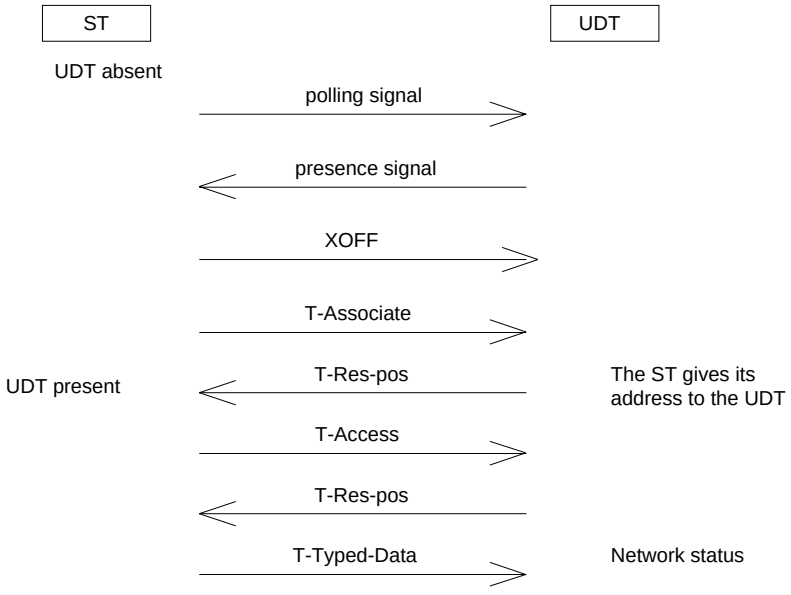

Figure 7: Initialisation protocol

15. Transmission of an uplink message by the UDT

15.1. Presentation

The System messaging proceeds by message switching.

In the case of an uplink message, the UDT sends the message to the ST. The ST then tries to send the message to the RSW on the radio channel. The message transmission acknowledgement of the Air Interface Protocol indicates to the ST the successful transmission of the message to the Radio Switch.

Transmission of the message on the radio channel can fail for several reasons:

- problem on the radio channel (loss of the ST - RSW link);
- pre-emption by a communication with a higher priority;
- crossover with a downlink message in the ST.

In every case, the ST sends the UDT an RTA reporting message, indicating the result of the transmission to the RSW (positive or negative), accompanied if necessary, by the reason for failure.

In case of failure, the ST considers that the transmission is terminated. In particular, it makes no attempt to retransmit and does not secure the message. The ST message buffer is considered to be empty. The UDT is responsible for subsequent retransmission of the message.

15.2. Procedure

The UDTUE can send a message to the ST if:

- the last uplink message sent by the UDT in the current association regime has received its RTA acknowledgement;
- there is no current ST -> UDT transmission (no transfer regime established);
- the UDT has established an access regime, solely to send a long message.

If these conditions are fulfilled, the UDTUE accepts the user request. The data exchange protocol is described in the Clause on "Managing exchanges between the ST and the UDT".

For long messages, the UDTUE segments the message, which is necessary if the number of octets to be sent exceeds the maximum length of the data field of a T-Write PE.

The UDT then waits for the RTA "Radio Transmission Acknowledgement", carried by a T-Typed-Data Protocol Element. The UDT will not make any further send message request as long as it has not received this acknowledgement.

Whatever the UDT’s response, it has to wait for the RTA/NRTA acknowledgement from the ST before sending another message.

If the UDT does not respond to the request for confirmation of non encrypted transmission, the ST aborts transmission of the message at the end of a timer and sends the UDT an NRTA.

15.3. Protocol elements sequence

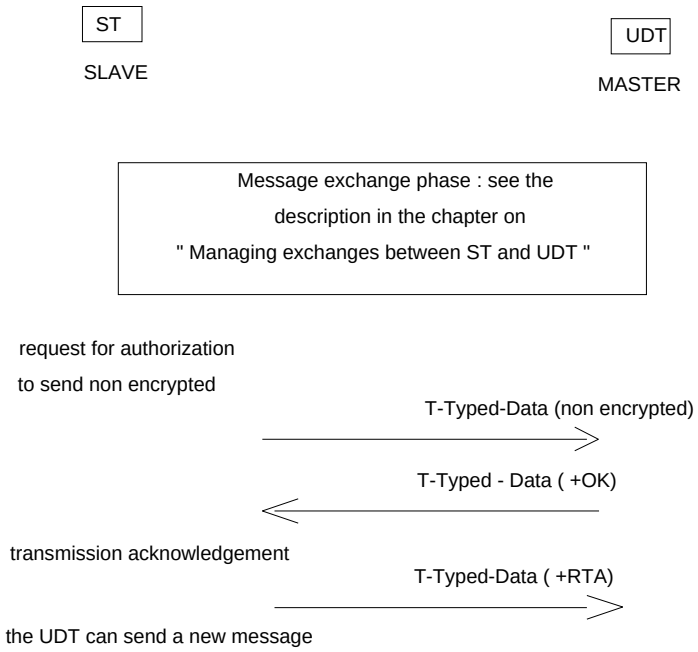

Figure 8: Uplink typed data sequence

16. Reception of a downlink Message by the ST

16.1. Presentation

If the ST receives a "transfer request for a downlink message" from the RSW and is not connected to a UDT, i.e. if an Access regime has not been established, this request is refused.

If the ST accepts, it receives the message and acknowledges it to the RSW. For the System, this acknowledgement means that the message has been successfully delivered to its recipient ST.

If the ST receives a message and cannot transmit it to the UDT and has already given an acknowledgement to the System, the message is kept in the memory. The ST cannot accept any further reception as long as the message has not been sent to the UDT.

16.2. Procedure

At the end of the transfer, the ST returns to the access regime. The ST keeps the transmission token.

Particular case: UDT maximum storage capacity reached

Two cases need to be examined:

- the downlink message is a short message;
- the downlink message is a long message.

In the 1st case:

The UDT cannot refuse the transfer of Typed-data.

At the end of the downlink transfer, the UDT disconnects the link. This supposes that the UDT manages a saturation threshold and interrupts the link before maximum storage capacity is reached.

In the 2nd case:

The UDTUE can refuse to establish the Transfer regime (T-Res-neg in response to T-Save) if its local message storage capacity is reached. In this case, the UDT disconnects the link (T-Abort), which closes the association regime and returns to the link initialisation status.

In both cases, the UDT refuses any request to establish Association (T-Res-neg), as long as its storage capacity is saturated.

16.3. Protocol elements sequence

The sequence of exchanges is described in the Clause on "Managing exchanges between the ST and the UDT".

17. Collision of uplink and downlink messages

17.1. Presentation

The collision of an uplink message and a downlink message can take place on different levels.

17.2. Collision after Transfer of an uplink message to the ST

17.2.1. Collision on the radio channel

The ST has started to send an uplink message on the radio channel. The message is pre-empted by a downlink message: the System applies priority rules defined in PAS 0001-1-1 [1].

If the uplink message is pre-empted, the ST sends an NRTA to the UDT.

17.2.2. Collision in the ST

The ST received and locally acknowledged the UDT->ST transfer (T-Write-End-RES primitive for a long message or T-Typed-Data-IND for a short message). A downlink message arrived before a radio transmission attempt was made. The downlink message always has priority over the uplink message. The transmission of the latter is put on hold by the ST, which shall transmit it on the radio channel when the downlink transfer is finished.

The ST then sends the UDT an RTA or NRTA depending on the result of the uplink transfer.

17.3. Collision during the transfer of an uplink message to the ST

17.3.1. Collision during the transfer request

If the transfer request for a downlink message arrives in the ST after the UDT has changed roles and taken the transmission token to transfer a long message (the message is stored in the ST’s transmission buffer), the STUE accepts the downlink transfer and stores the message in its reception buffer. The STUE changes roles on reception of the T-Write-End to transmit the downlink message to the UDT.

17.3.2. Collision during transfer

The UDT is transmitting an uplink message while the network is transmitting a downlink message to the ST.

If the downlink message transfer request (whatever its length) arrives in the ST and the UDT has already established the transfer regime, the STUE accepts the downlink transfer and stores the message in its reception buffer. The STUE changes roles on reception of the T-Write-End to transmit the downlink message to the UDT.

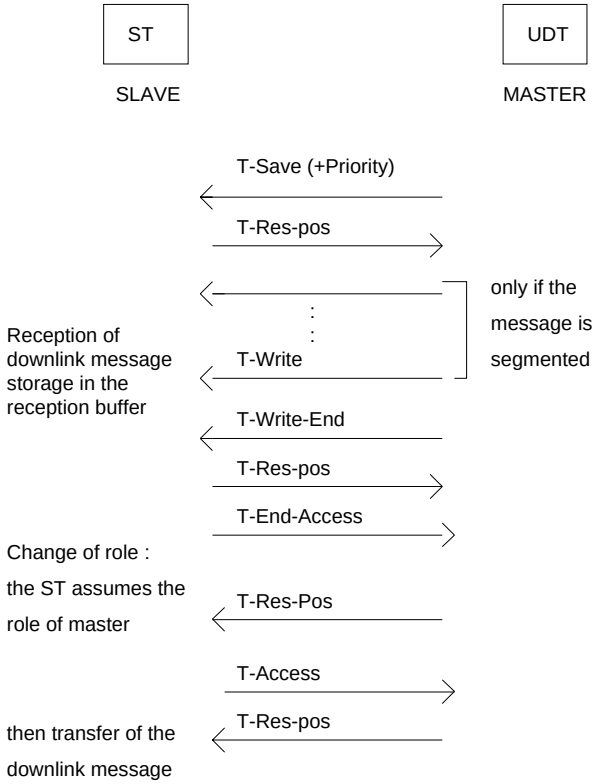

Figure 9: Collision protocol

18. Monitoring the ST-UDT link

18.1. Presentation

Monitoring aims at enabling each entity know the status of the distant entity (present, absent) and the status of the asynchronous link at any moment, in order to know whether a message can be transferred.

If the UDT is absent, the ST refuses the RSW's request to transmit a downlink message.

18.2. Principle

18.2.1. The ST is master

In established Access regime, outside the Transfer regime, the ST polls the UDT.

At regular intervals, the STUE sends the UDTUE a poll message. The transport acknowledgement of this message enables the STUE to detect any fault.

For the UDTUE, non reception of this reporting message indicates a fault.

The entity which detects a fault, locally ends the Association and Access regimes and restarts the initialisation procedure described above.

18.2.2. The ST is the slave

This situation is transitory and only lasts for the duration of transmission by the UDT of a long message.

During this phase, the ST checks that the UDT is sending data. If this is not the case, the ST ends the Access regime established by the UDT and assumes the role of master.

18.3. Procedure

Every T-Typed-Data PE sent by the ST polls the UDT (this PE is acknowledged by the remote entity at transport level).

Three timers are necessary:

- T1, on ST side, defines periodicity of the poll. Expiration of T1 means that, as there is no other PE to send, the STUE must send a T-Typed-Data PE poll. T1 is set when any T-Typed-Data is sent.
- T2, on UDT side, is active during the poll wait. It is reset on reception of any T-Typed-Data. Expiration of T2 means that the poll signal has not been received in time. T2 must be greater than T1.
- T3, on ST side, is active when the ST is slave. It is set on reception of T-End-Access. Its expiration means that the UDT has assumed the role of master and that it has not carried out a complete transfer.

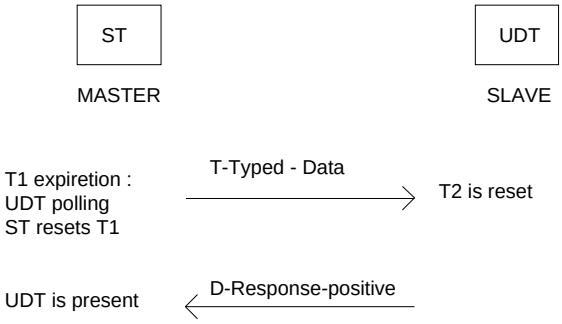

Figure 10: Polling sequence

18.4. Case of a link break outside transfer regime

A break in the ST-UDT link can have many causes such as one of the entities being switched off or a disconnected cable.

The effects are:

- on ST side: the absence of a transport level acknowledgement to a T-Typed-Data PE. This case is described in the section on "Processing errors". It results in the ST sending a T-Abort PE and exit from the Association regime;
- on UDT side: the expiration of T2 timer. The UDTUE then sends a T-Abort (User) which locally ends the Association regime.

In all cases the two UEs exit, after a given time (depending on the values of T1 and T2), from the Association regime and resume the initialisation procedure.

Whenever a link is re-initialised:

- the ST cancels any Radio Transmission Acknowledgement (RTA) for the UDT;
- the UDT can send a message, without waiting for the RTA of a message sent before reinitialisation.

If the message contained in the transmission buffer has not been sent on the radio channel, the ST refuses all uplink message transfer requests.

It sends to the UDT:

- a T-Transfer-reject, on reception of the T-Save sent by the UDT for the transfer of a long message;
- Typed data containing an NRTA on reception of a short message in Typed data.

The ST carries out the transmission of the 1st message. The UDT will then receive an RTA or NRTA, for the 1st message.

19. Timer management

19.1. Timers used by the TAS supplier

19.1.1. At ETP Level

A response timer (defined by STUTEL) fixes the maximum wait duration at ETP level: its expiration indicates to the sender of a D-Set-Mode or D-Data PE, that a transport acknowledgement (D-Response-x or D-Data) was not received in time. The transmission is then retried by the ETP.

After five unsuccessful attempts, the transmitter's ETP sends a D-Abort PE, which causes disconnection from STUTEL and return to the initialisation sequence.

The value of this timer (3 seconds) is fixed by the STUE when the D-Set-Mode PE is sent. It is the same for both UEs.

The inactivity timer defined by STUTEL is not used for the ST-UDT link, which remains permanently established.

19.1.2. At TAP Level

A confirmation timer fixes the maximum time necessary to respond to a TAP Service request with explicit confirmation. This time is controlled by the UE sending the request: its expiration indicates to the sending UE that the remote entity has not responded in time. The Service request is then retried by the TAS.

After five unsuccessful attempts, the transmitter TAS sends a D-Abort PE, which causes exit from the Association regime and return to the initialisation sequence.

The STUE and the UDTUE define their own values (3 seconds) and exchange them when establishing the Association regime.

19.2. Timers used by STUE and UDTUE

Monitoring the ST-UDT link uses two T1 and T2 timers.

Monitoring is only put into service when the ST is master and outside the Transfer regime. The implications for the management of T1 and T2 are as follows:

19.2.1. T1 Management

- ST sets T1 on establishment of its Access regime (reception of T-Res-pos in response to T-Access). It deactivates T1 on exit from the Access regime (reception of T-End-Access or T-Abort);
- ST deactivates T1 when requesting establishment of a transfer regime (sending T-Save). It resets T1 when it exits from this regime (reception of T-Res-pos primitive in response to T-Write-End or T-P-Exception);
- ST resets T1 at each transmission of T-Typed-Data (each of these PEs constitutes a poll signal).

The value of T1 is set at [15] seconds.

NOTE: Sending T-Save does not mean that the Transfer regime is established, in particular since a transport level error can occur when sending T-Save.

Two cases can occur:

- T-Save not acknowledged or is acknowledged negatively five times: the ETP sends a D-Abort, which causes an exit from the association regime and a return to initialisation;

- T-Save is acknowledged negatively, but can be subsequently resent successfully: this is a return to a normal case.

19.2.2. T2 Management

- T2 is set by the UDT, when the ST establishes an Access regime (UDT sending T-Res-pos in response to T-Access) and is deactivated on exit from this regime (transmission of T-End-Access, transmission or reception of T-Abort);

- T2 is deactivated by the UDT, on reception of a Transfer regime establishment request from the ST (reception of T-Save) and set when leaving this regime (transmission of T-Res-pos in response to T-Write-End);

- T2 is set at the reception of a T-Typed-Data.

The value of T2 set at [30] seconds.

19.2.3. T3 Management

To make sure that the line is active when the ST is slave (i.e. that the ST does not remain blocked in this mode), it is necessary to define, in the ST, an extra timer, T3.

T3 is managed by the STUE: it is set on reception of T-End-Access and deactivated on reception of T-Write-End or T-Abort.

On expiration of T3, the ST automatically resumes the role of master by ending the UDT's access regime. T3 must therefore be greater than the maximum duration of an uplink message transfer from the UDT to the ST.

The value of T3 set at [30] seconds.

On expiration of T3:

- if a UDT Access regime remains established without a transfer regime, STUE ends it (transmission of T-End-Access), then re-establishes the ST's Access regime.

  - if there is a current Transfer regime, the STUE:

    - interrupts it (transmission of T-Transfer-reject and aborts the transfer);

    - ends the UDT's Access regime (T-End-Access);

    - establishes the ST's Access regime.

- if the ST is in an Association regime, with no Access regime established, the STUE send a T-Abort PE.

20. Error Processing

Error processing takes place on two levels, on the ETP level and on the TAP level.

20.1. ETP level

20.1.1. Recoverable transport level errors

These give rise to a negative transport acknowledgement sent to the remote entity, which shall then retransmit the erroneous frame.

These errors are:

- protocol element (PE) with a bad BCS;
    - PE with an incorrect sequence number;

- PE larger than the maximum size allowed.

The last two causes are a result of a STUTEL protocol production error.

20.1.2. Unrecoverable transport Level errors

These give rise to error reporting on the upper layer (TAP):

- reception of a D-Set-Mode PE even though connection has been established;
  - unacceptable parameter or parameter value in a D-Data PE;
- protocol error (unknown PE, unexpected PE, incorrectly-coded PE).

These three causes are a result of a STUTEL protocol production error:

- transmission of more than five successive D-Response-negative PEs;
- error reporting to a lower layer;
  - expiration of the transport acknowledgement wait timer;
- expiration of the inactivity timer, this timer is deactivated in the product described here.

20.2. TAP Level

This decision to send an error reporting frame can be taken by the user or by the TAP supplier.

20.2.1. User error

Two types of PE can be sent at the user's request:

- T-Abort: used to monitor the link;
- T-Transfer-reject: can be sent by the ST to cause a UDT->ST transfer abort, on expiration of T3.

20.2.2. Supplier error

The behaviour of the TAS supplier depends on the current regime and the nature of the error detected.

In established Access regime:

- The supplier can send a T-P-Exception to the remote entity in the following cases:
  - transmission or reception of repeated negative acknowledgements (T-Res-Neg);
  - protocol conflict: reception of an unexpected PE;
  - syntax error/absence of parameter;
  - unprocessed protocol element;
  - other cause.

These errors should in theory not occur when the protocol is used, because the primitives are fixed and are not negotiated.

- time out (confirmation not arrived in time).

The two entities are in the idle situation of the established Access regime.

- The supplier can send a T-Abort EP to the remote entity in the following cases:

- reception or transmission of five consecutive T-P-Exception PEs;
- error reporting to lower layers.

The two entities exit from all current regimes and resume the initialisation procedure.

In an Association regime, but outside an Access regime.

Only a T-Abort PE can be sent in the following circumstances:

- reception or transmission of successive negative acknowledgements (T-Res-neg);
- syntax error/absence of parameter;
  - unknown message;
- protocol conflict.

These errors should in theory not occur when the protocol is used.

  - error reporting to low layers;
- other cause.

21. Primitives used by the UE-STUTEL Interface

Table 1: Primitives sent by ST

Primitive sent by the ST UE	Primitives received by the UDT UE
T-Associate-Req	T-Associate-Ind
T-Access-Req	T-Access-Ind
T-Access-Res	T-Access-Conf
T-End-Access-Req	T-End Access-Ind
T-End-Access-Res	T-End-Access-Conf
T-Save-Req	T-Save-Ind
T-Save-Res	T-Save-Conf
T-Write-Req	T-Write-Ind
T-Write-End-Req	T-Write-End-Ind
T-Write-End-Res	T-Write-End-Conf
T-Typed-Data-Req	T-Typed-Data-Ind
T-Transfer-Reject-Req	T-Transfer-Reject-Ind
T-U-Abort-Req	T-U-Abort-Ind
	T-P-Exception-Ind
	T-P-Abort-Ind

Table 2: Primitives sent by UDT

Primitives send by the UDT UE	Primitive received by the ST UE
T-Associate-Res	T-Associate-Conf
T-Access-Req	T-Access-Ind
T-Access-Res	T-Access-Conf
T-End-Access-Req	T-End Access-Ind
T-End-Access-Res	T-End-Access-Conf
T-Save-Req	T-Save-Ind
T-Save-Res	T-Save-Conf
T-Write-Req	T-Write-Ind
T-Write-End-Req	T-Write-End-Ind
T-Write-End-Res	T-Write-End-Conf
T-Typed-Data-Req	T-Typed-Data-Ind
T-U-Abort-Req	T-U-Abort-Ind
	T-Transfer-Reject-Ind
	T-P-Exception-Ind
	T-P-Abort-Ind

22. Format of STUTEL Protocol Elements

The structures of STUTEL Protocol Elements (PE) which are used in the System are given hereafter:

- T-Associate transported by D-Set-Mode;
- T-Access transported by D-Data.

After establishing the Access regimes other PEs make it possible to transfer messages and reporting. They are transported by D-Data PEs of STUTEL Transport:

- T-End-Access;
- T-Save;
- T-Write;
- T-Typed-Data;
- T-Transfer-reject;
- T-U-Abort.

ETP SD	= $1F = $3E	
CI = D-Set-mode	=$76	BCS/confirmation requested/translation mode 3
Sequence Code	=$40	
LI1	=$06	
T = DDU mode	=$23	(DDU: Dialogue Mode Unit)
Length	=$01	
Value	=$03	
T = DDU req. timer	=$20	
Length	=$14	
Value	=$03	Value in seconds
CI = T-Associate	=$20	EP T-Associate
LI2	=$14	
T = Calling Add.	=$42	
Length	=$05	
0 ST Address (RFGI format)		
T = appli.name	=$45	
Length	=$02	
Value	= $21 = $54	(see note)
T = App.resp.timeout	=$46	
Length	=$01	
Value	=$08	Value in seconds
T = Explicit Conf.	=$4C	
Length	=$01	
Value	=$08	Symmetrical service
T = Explicit Conf.	=$4C	
Length	=$01	
Value	=$02	
BSC 3-in-4 coding		
End Delimiter	=$0D	

Figure 11: Format of a D-Set-mode PE transporting a T-Associate (req) PE

NOTE: The name of the application is "telesoftware service alone" in conformity with STUTEL software suppliers standard profiles.

D-Set-Mode / parameter by default:

- inactivity timer deactivated

T-Associate / parameter by default:

- request identification = no

T-Associate / option parameters not used:

- called address
  - identification
- user data (not used in the STUTEL Telesoftware Service)

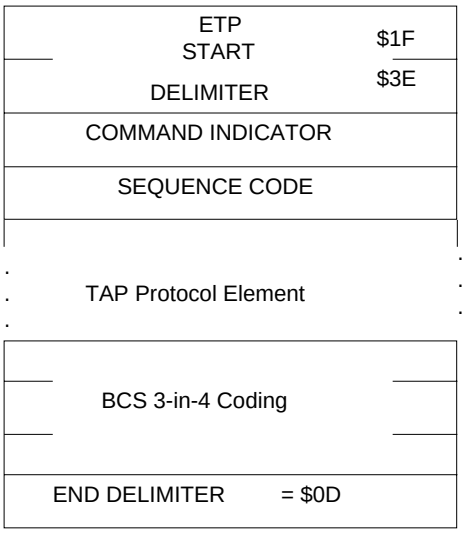

Figure 12: General format for ETP D-Data

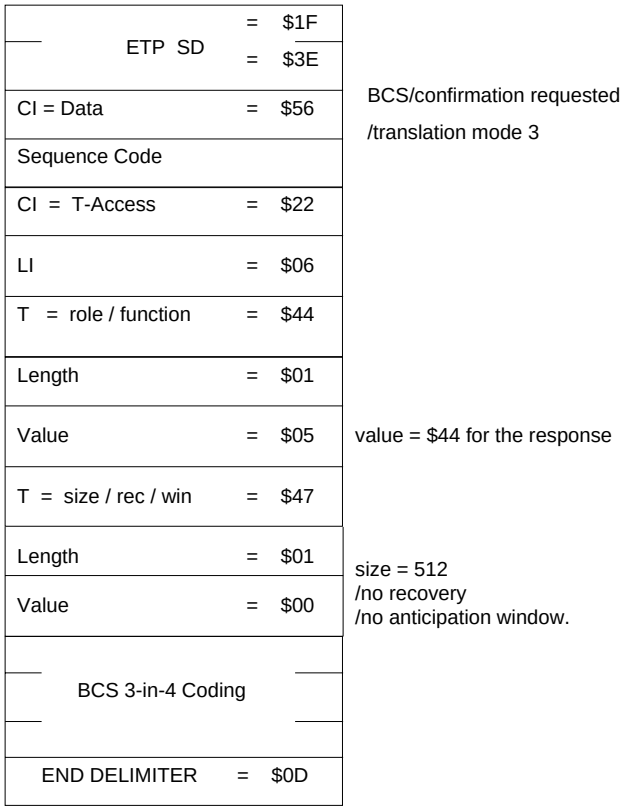

Figure 13: Format of a D-Data PE transporting a T-Access (req) PE

T-Access / parameter by default:

user data = T-Save applies to all accessible "A" files only (STUTEL telesoftware application).

Functions allocated in master role: (b0=1)

T-Transfer-reject repetition not accepted (b1=0)

T-Typed-Data accepted (b2=1)

Functions allocated in slave role: (b0=0)

T-Typed-Data accepted (b2=1)

T-Save accepted (b6=1)

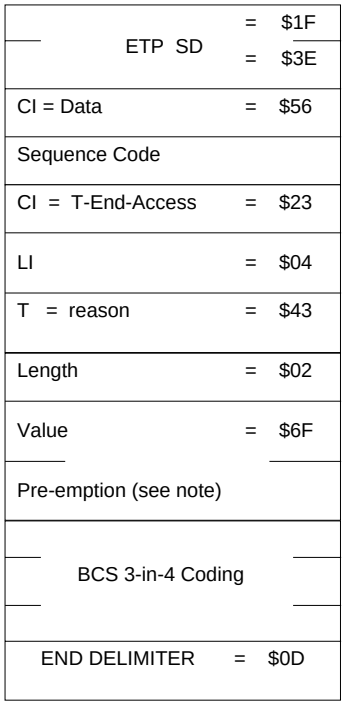

Figure 14: Format of a D-Data PE transporting a T-End-Access (req) PE

T-End-Access / optional parameter not used:

user data

NOTE: This field indicates whether it is possible to "pre-empt" the access regime to be established:
- if the T-End-Access PE is sent by the ST, this octet always has a value of $81.
- if the T-End-Access PE is sent by the UDT, this octet takes on the following meaning:
= $81 => uplink FLASH message
= $80 => uplink URGENT or ROUTINE message

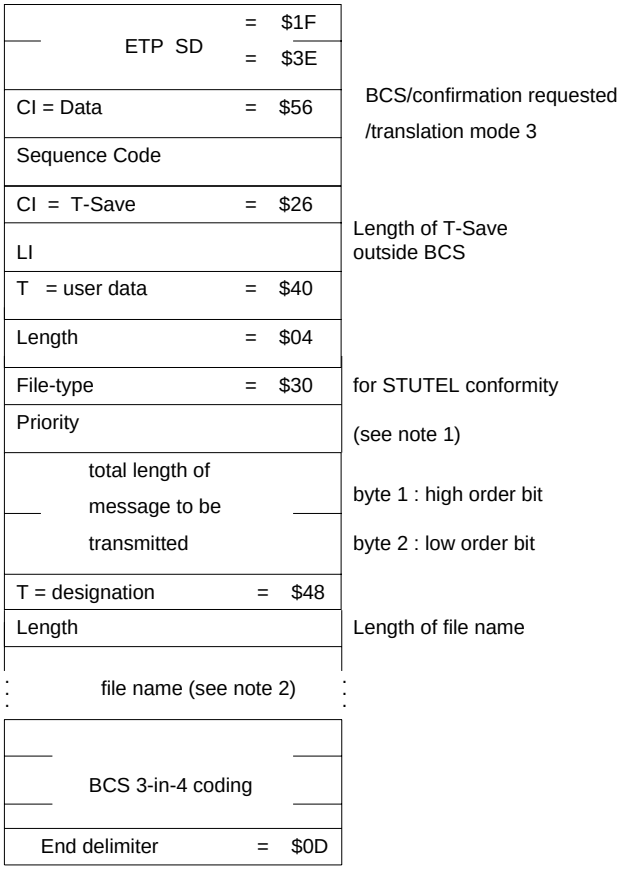

Figure 15: Format of a D-Data PE transporting a T-Save PE

T-Save / optional parameters not used: recovery point

NOTE 1: "priority" is:

- $03 for a ROUTINE message;
- $07 for an URGENT message;
- $0B for a FLASH message;

NOTE 2: "file name" is:

- free for the UDT to choose in the uplink direction (as the ST only has one buffer to manage, it ignores this parameter);
- "RFGxx.I" in the downlink direction, RFSI being the address of the ST associated to the UDT, xx being a modulo 100 sequential number managed by the ST (this number is in unsaved RAM): the name transmitted by the ST is 12 characters long. The attribution of file names to messages received is a local function of the UDT.

Format of a D-Data PE transporting a T-Write PE

The TAP T-Write PE corresponds to TAS primitives: T-Write and T-Write-End

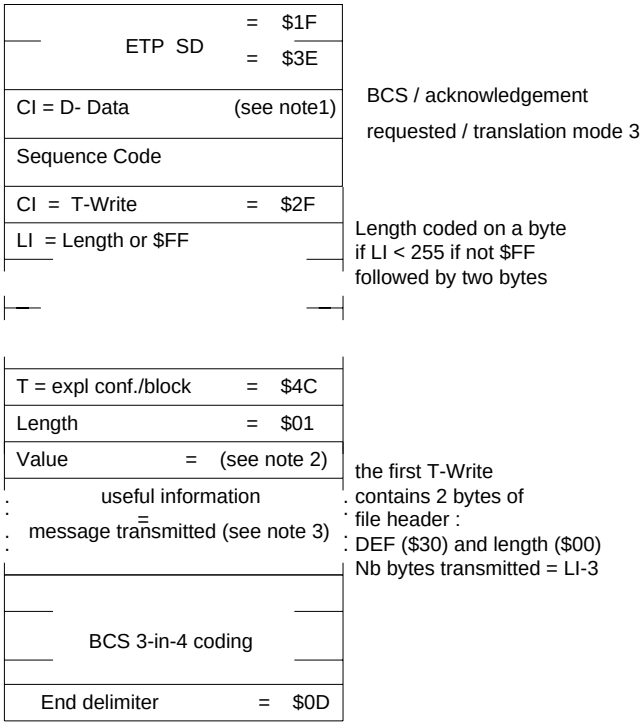

Figure 16: Format of D-DATA with T-write

T-Write / optional parameter not used: Block number:

NOTE 1: first block => CI = $5E
intermediate block' => CI = $5E
last block => CI = $56
first and last block => CI = $56

NOTE 2: The parameters "Explicit confirmation" and "block" are encoded on a single octet:
first block => Val = $01
intermediate block => Val = $00
last block => Val = $0A
first and last block => Val = $0B

NOTE 3: Message formats are described in PAS 0001-13-2 [4].

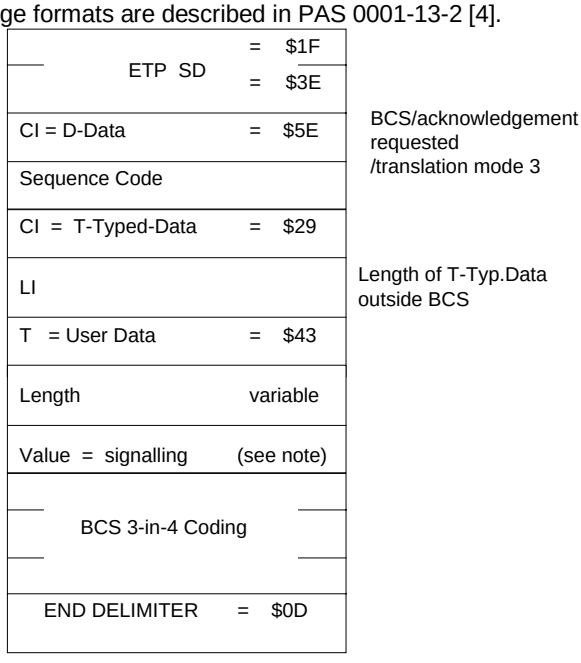

Figure 17: Format of a D-Data PE transporting a T-Typed-Data PE

NOTE: The signalling field is coded as follows:

Table 3: Signalling field coding

Length	Report	Origin
03	1 = positive radio transmission acknowledgement	ST
06	2 = negative radio transmission acknowledgement	ST
01	3 = reserved value	
01	4 = reserved value	
01	5 = reserved value	
01	6 = poll message from ST to UDT	ST
01	7 = reserved for future use	
01	8 = alarm start ringing request	UDT
01	9 = end alarm ring request	UDT
12	10 = status information	ST
01	11 = reserved for future use	
01	12 = reserved for future use	
254	13 = data transfer	ST/UDT

The structure of the Radio Transmission Acknowledgement (RTA) is as follows:

- the 1st octet indicates whether it is positive or negative (RTA/NRTA);

  the 2nd and 3rd octets contain the number of acknowledged message. (IDLOCAL Field of header 1 of MT protocol element (see PAS 0001-13-2 [4]);

  - the 4th octet contains the general failure cause, called family;

- the 5th and 6th octets contain the manufacturer's failure cause, given as a CAUSE and a failure CODE.

The structure of data transfer is composed of the Submit/Delivery Protocol Elements defined in PAS 0001-13-2 [4].

The status information contain a TLV type information set.

The T field of status information can take the following values:

- Network status: code = 1
- Network number: code = 2

- Cell numbers: code = 3

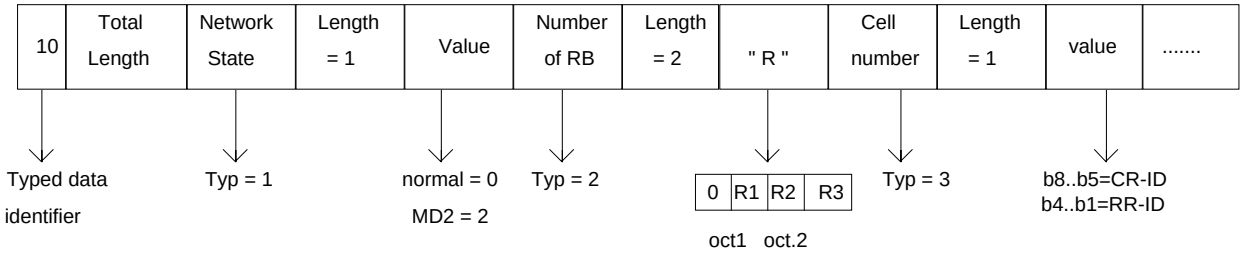

Figure 18: Signalling field structure for the type "state information"

This PE makes it possible for the ST to interrupt the transfer of an uplink message and pre-empt it with a downlink message.

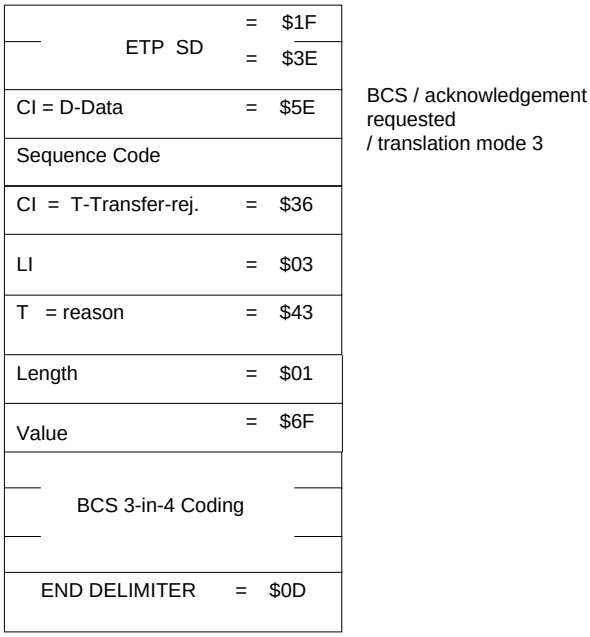

Figure 19: Format of a D-Data PE transporting a T-Transfer-Reject PE

Cause $6F is not followed by any additional octet.

This PE makes it possible for the ST or the UDT to interrupt the connection established between the ST and the UDT following an incident.

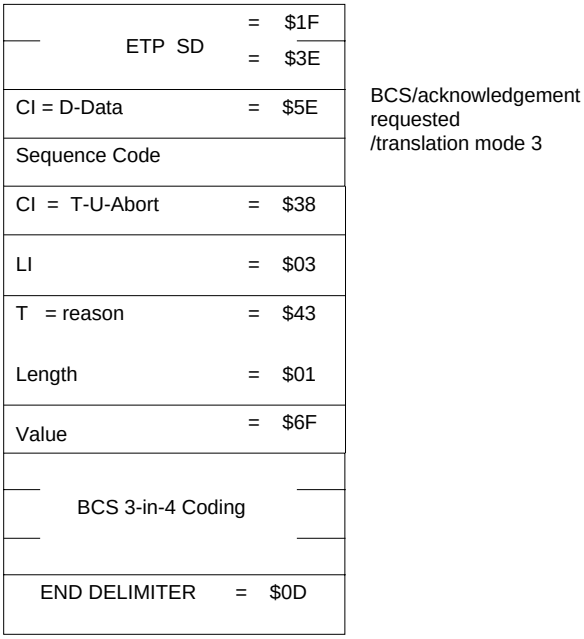

Figure 20: Format of a D-Data PE transporting a T-U-Abort PE

Cause $6F is not followed by any additional octet.

23. Presentation of the STUTEL protocol

This Clause summarises STUTEL characteristics. For a more detailed study, refer to ETS 300 075 [3].

23.1. Introduction

STUTEL was standardised by ETSI/CEPT (Standard ETS(G) or ETS 300 075).

FRANCE TELECOM recommends using STUTEL for file transfers on ISDN between PCs.

The main characteristic of STUTEL is that it provides services greatly inspired by those defined by OSI, without layering seven protocol levels.

Two layers are defined, with their access interfaces:

- a transport protocol which provides low layer functions, while remaining network configurable. It can be installed directly on an asynchronous physical level, on an HDLC link, an X.25 or ISDN network, or be replaced by an OSI transport/session;
- a Telesoftware Access Protocol (TAP), which manages the higher layers and directs transport/layer, for data transfer and file management.

STUTEL is made up of modules. In each Protocol, Services are used as and when needed by the application and the network environment. A negotiation is carried out on connection which enables the two communicating entities to adopt a common profile.

23.2. STUTEL Transport

The transport protocol handles of network aspects and adapts to the topology of the lower layers.

The services offered are:

- error detection (identical to the X.25 FCS): optional;

- choice of transport mode:

  structure and coding of protocol elements (delimiters and data block formats);

  five transport modes are defined;

- choice of translation:

  octet coding to ensure the transparency of data blocks transmitted (with respect to data block delimiters);

  four translation modes are defined;

  - choice of acknowledgement mode (in error detection):

    the data blocks can be acknowledged by the receiver's transport protocol (mode with acknowledgement) or by the access protocol (TAP), to which these blocks are supplied (mode with confirmation);

Five Protocol Elements (PE) are defined for transport:

- D-Set-Mode;
- D-Data;
- D-U-Abort;
- D-Response-positive;
- D-Response negative.

The choice of STUTEL transport services depends on the services already available in the lower layers: if a service is already provided by the link or network levels, the STUTEL service is not used.

STUTEL defines several Transport configurations:

- ETP (Extended Transport Protocol) including all the services offered by STUTEL. It is suitable for asynchronous links in the absence of level 2. ETP is then directly installed on the asynchronous handler.
- RTP (Reduced Transport Protocol). This is suitable for the TELETEL network, which already has its own Error Correction Procedure (PCE) for the downlink direction (1200 bauds channel).
- When OSI Session and Transport protocols are present, STUTEL transport can be dispensed with.
- By standardising STUTEL at European level, ETSI has defined an additional configuration in which STUTEL can be installed directly on an X.25 network or on an RNIS B channel, without transport or session (Annex ETS 06-10).

23.3. Telesoftware applications protocol (TAP)

The name of this protocol can give rise to confusion. It is the mechanism used to exchange data (files) between two entities.

TAP defines two service classes:

- the "basic kernel" class in which the calling party is always master and data transmitter. The only service available is data transfer;
- the "symmetrical service" class in which the roles of master, slave, transmitter and receiver are distinguished.

- the initiator of the access request allocates the master and slave roles. These roles can be changed in the course of a session (or association according to STUTEL), or after access.
- The master allocates the roles of transmitter and receiver and can change them round.
- Exchange operations take place for:
- file backup (master to slave);
- file loading (slave to master);
- reading a slave's directory;
- changing a slave's file name;
- suppression of a slave's file;
- bi-directional sending of typed data.

TAP offers the application some services that can be accessed by primitives. Concepts defined by OSI are used.

A "service request" primitive is sent by a user called "initiator".

This request is carried from the sender TAP to the recipient TAP in a Protocol Element (PE).

The request is given to the recipient user (called "acceptor") in a "service indication" primitive.

The acceptor can respond with a "service indication response" primitive.

This response is given to the initiator in a "service request confirmation" primitive.

Several service types are defined:

- confirmed Service (C): it is mandatory that the service indication primitive is confirmed by a response primitive, sent by the acceptor;
- optionally Confirmed Service (OC): the service indication primitive is only confirmed if the initiator makes a request;
- not confirmed Service (NC): no confirmation provided.

In order to optimise the transfer of large quantities of information, the TAP introduces the notion of restart point (analogous with the ISO session synchronisation point), that the transmitter places at regular intervals in its file. Restart and anticipation mechanisms are attached to it, but their use is optional.

The coding of TAP protocol elements takes a TLV (Type Length Value) form. It is the same type as the parameter coding of the ISO session layer.

24. Scenario of STUTEL data flow

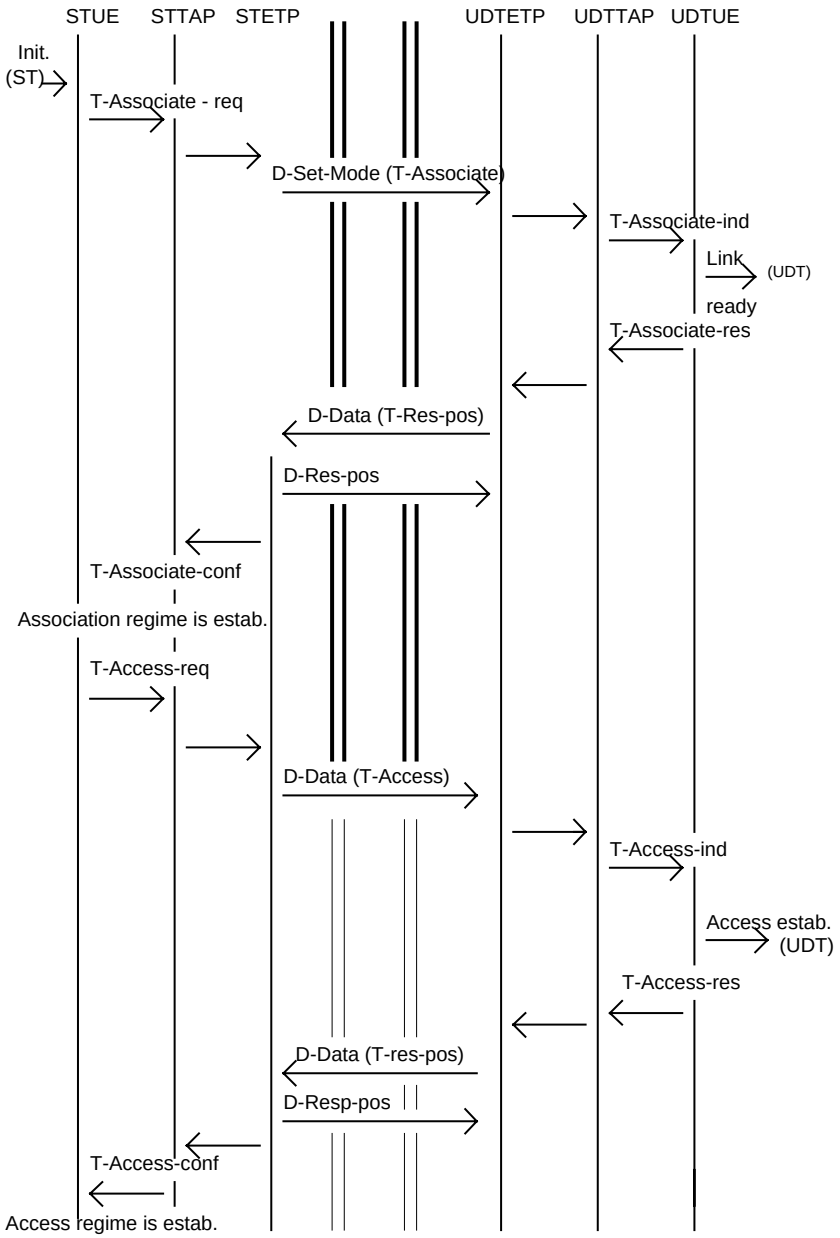

Figure 20: Initialisation of the ST-UDT link: establishing Association regime establishing Access regime

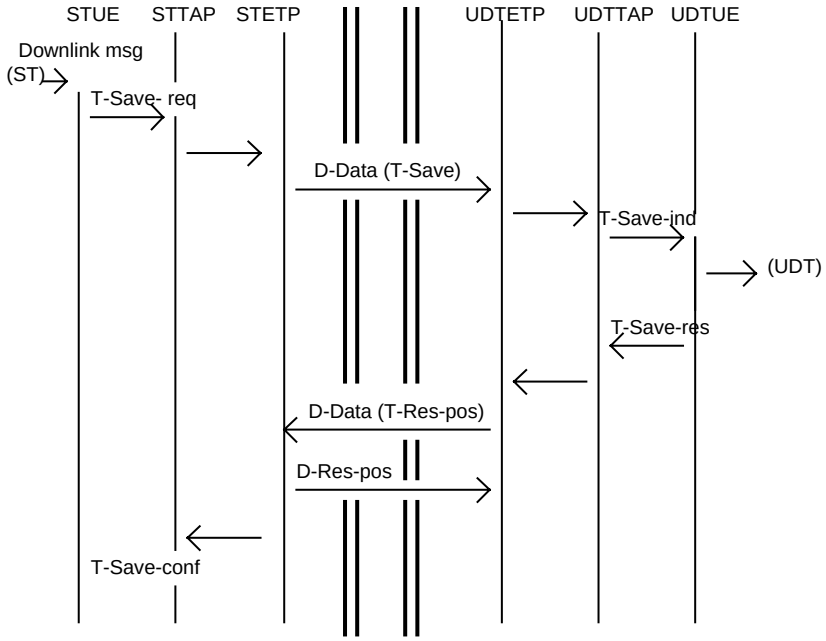

Figure 21: ST Master: transmission of long message from ST to UDT establishing Transfer Regime

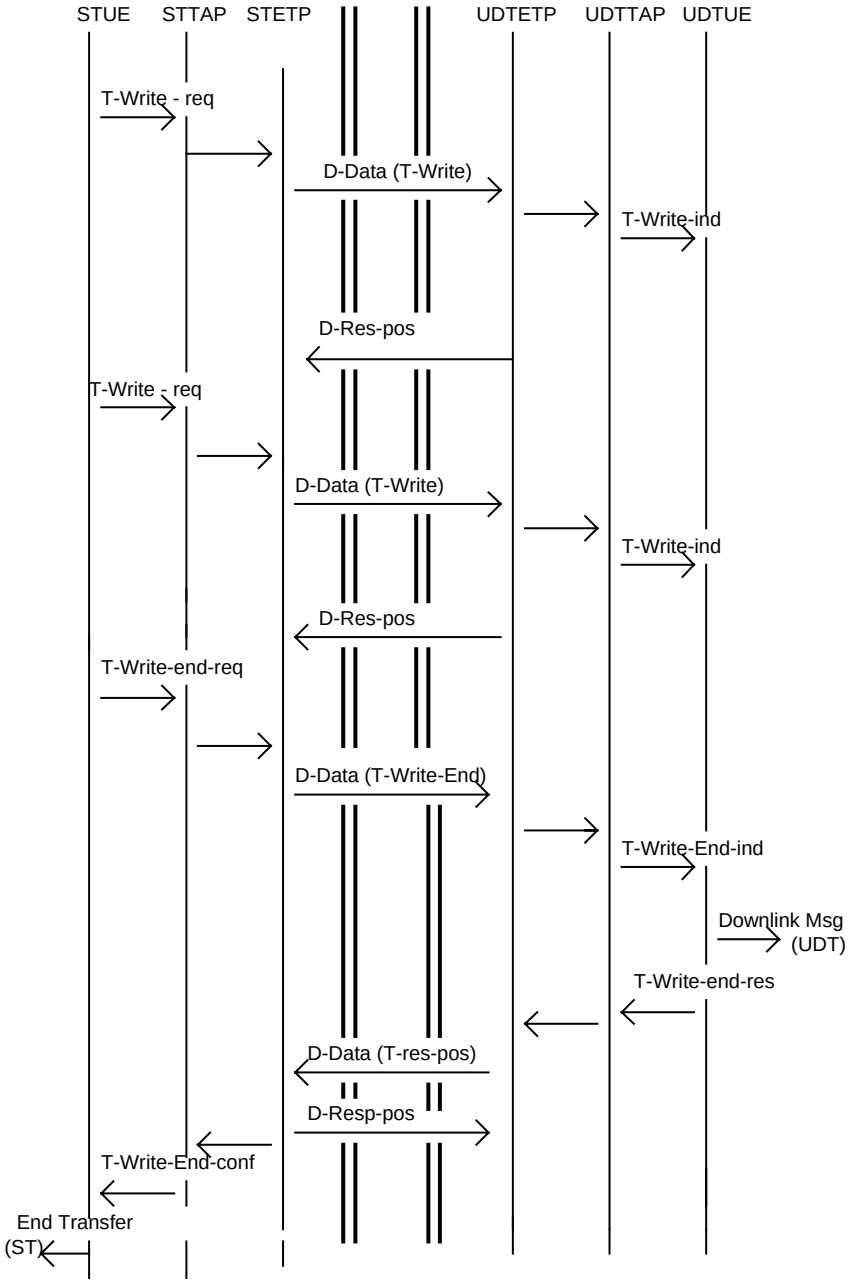

Figure 22: Transfer Regime is established: ST originator (Master) UDT recipient (Slave)

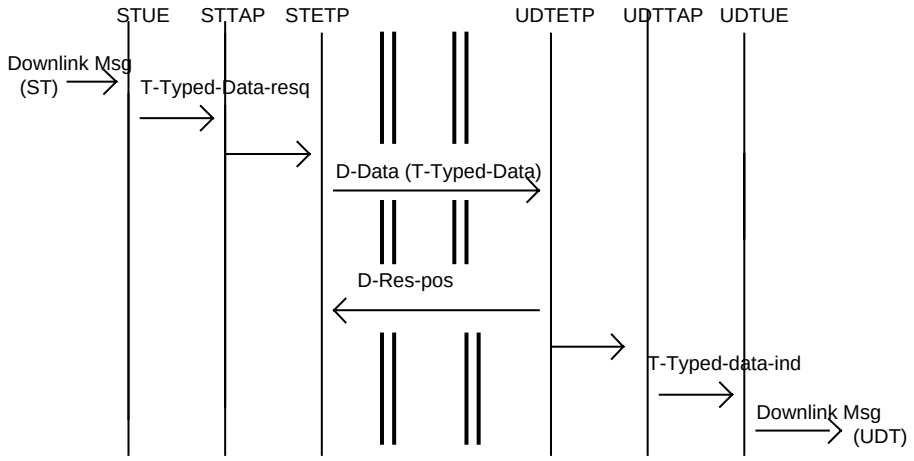

Figure 23: ST Master: transmission of a short message from ST to UDT

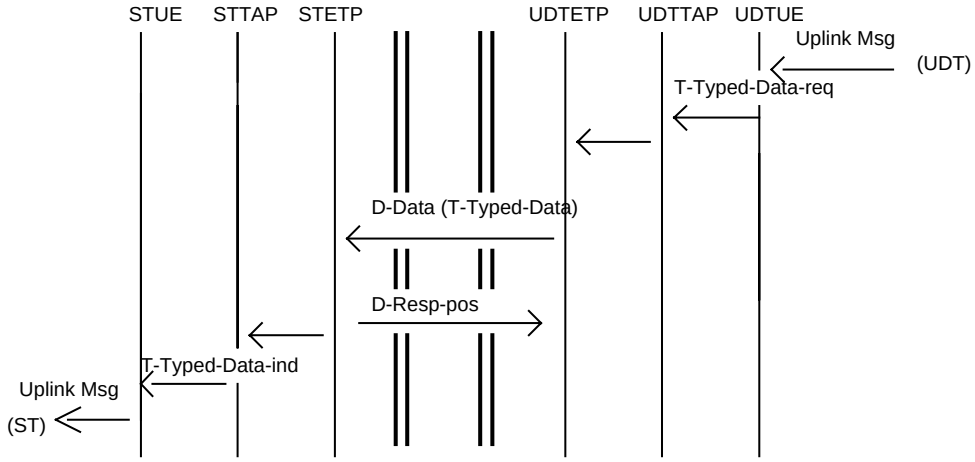

Figure 24: ST Master: transmission of a short message from UDT to ST

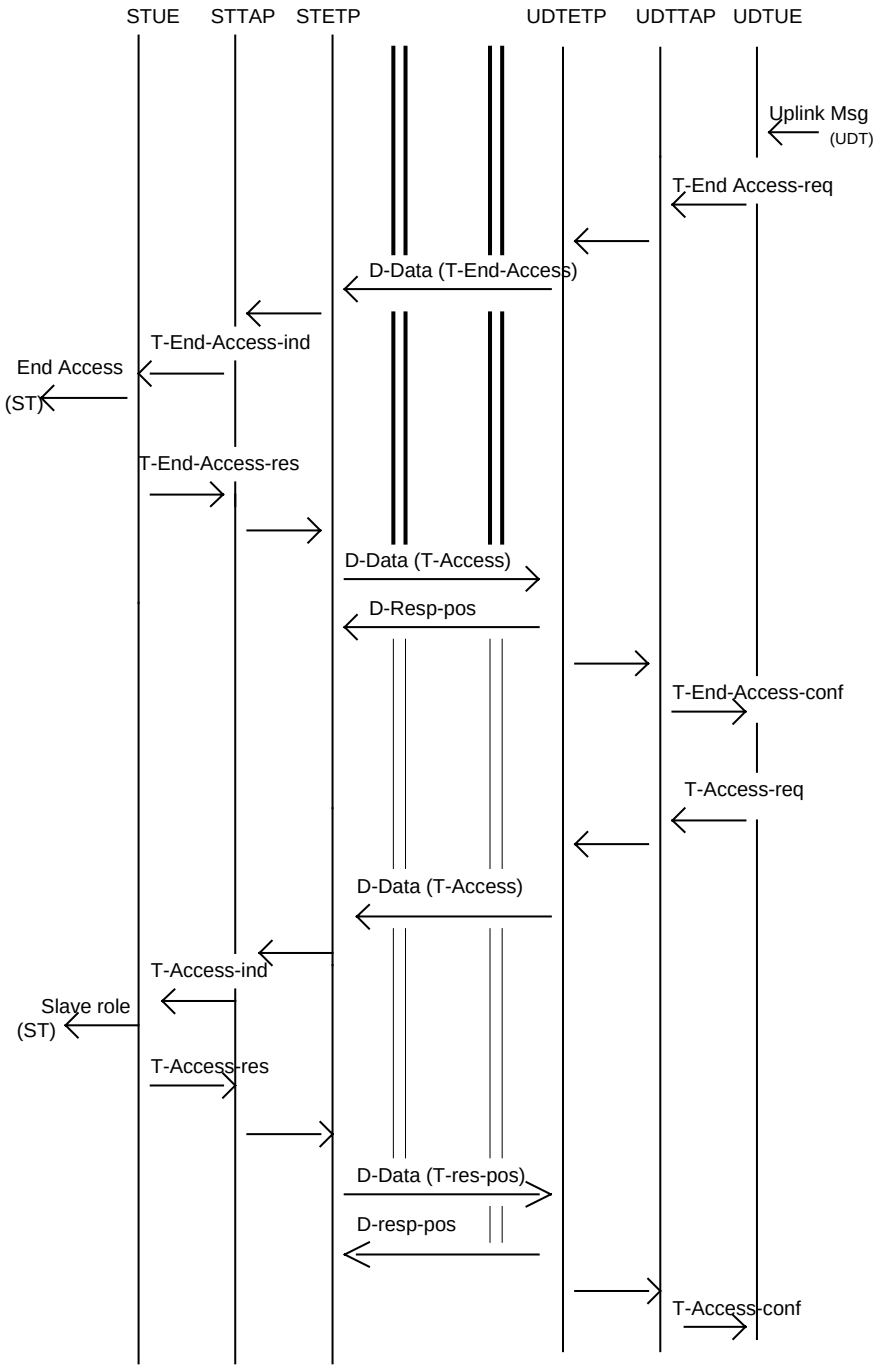

Figure 25: Change of role on UDT Request (transmission of a long Uplink message)

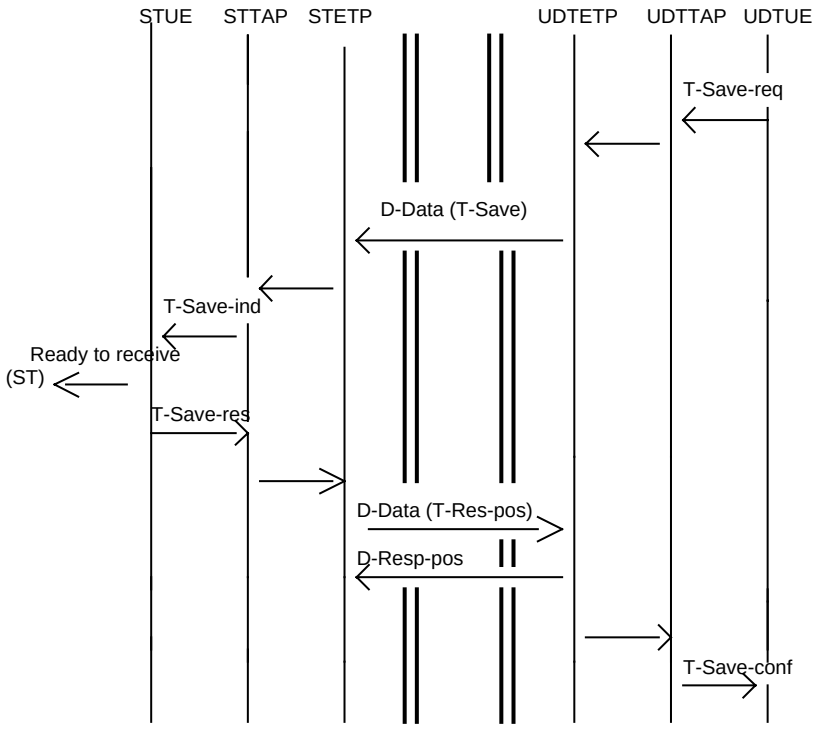

Figure 26: Another Access Regime is established ⇒ UDT Master, ST Slave

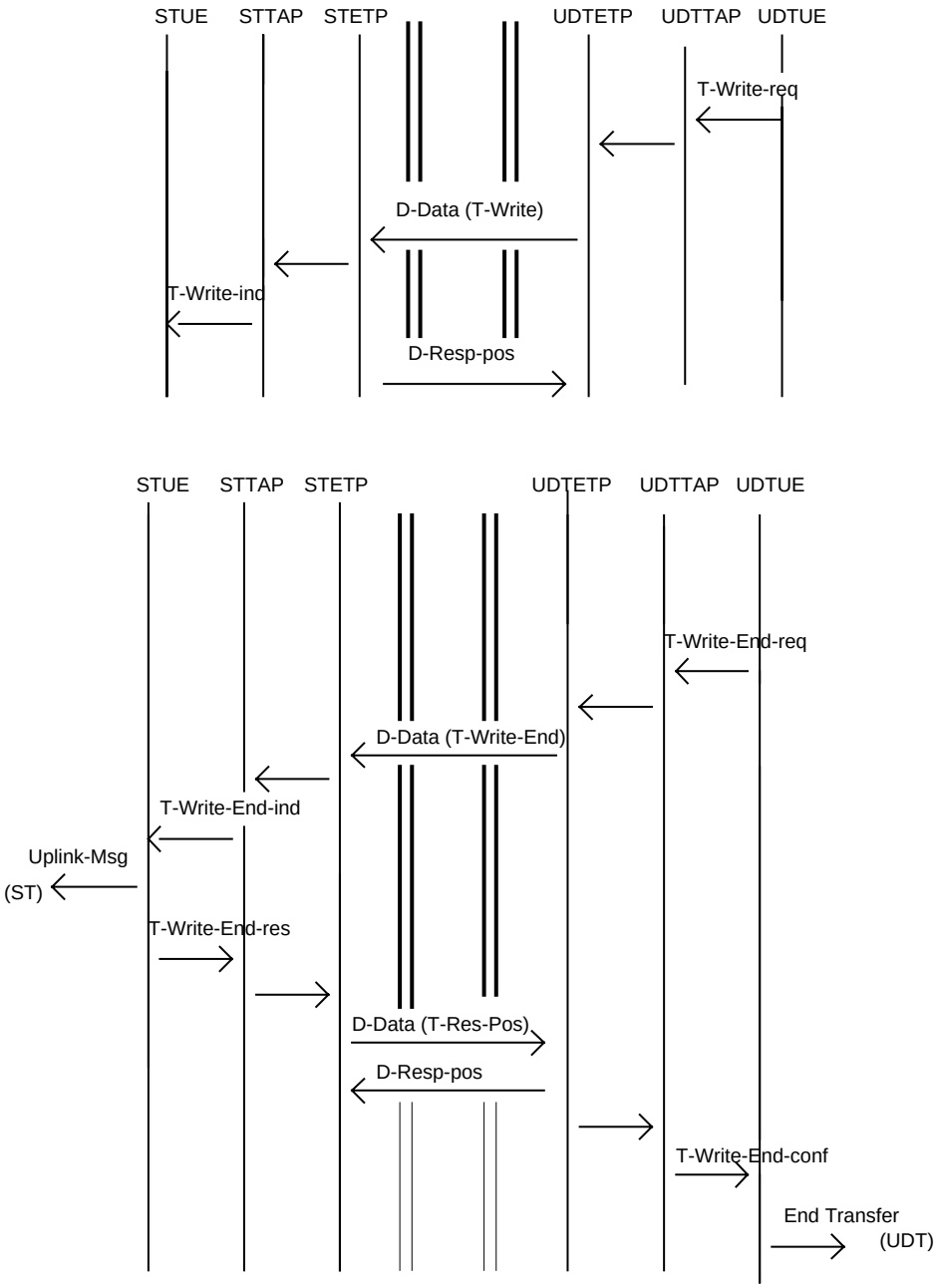

Figure 27: Transfer regime is established ⇒ UDT master, ST Slave

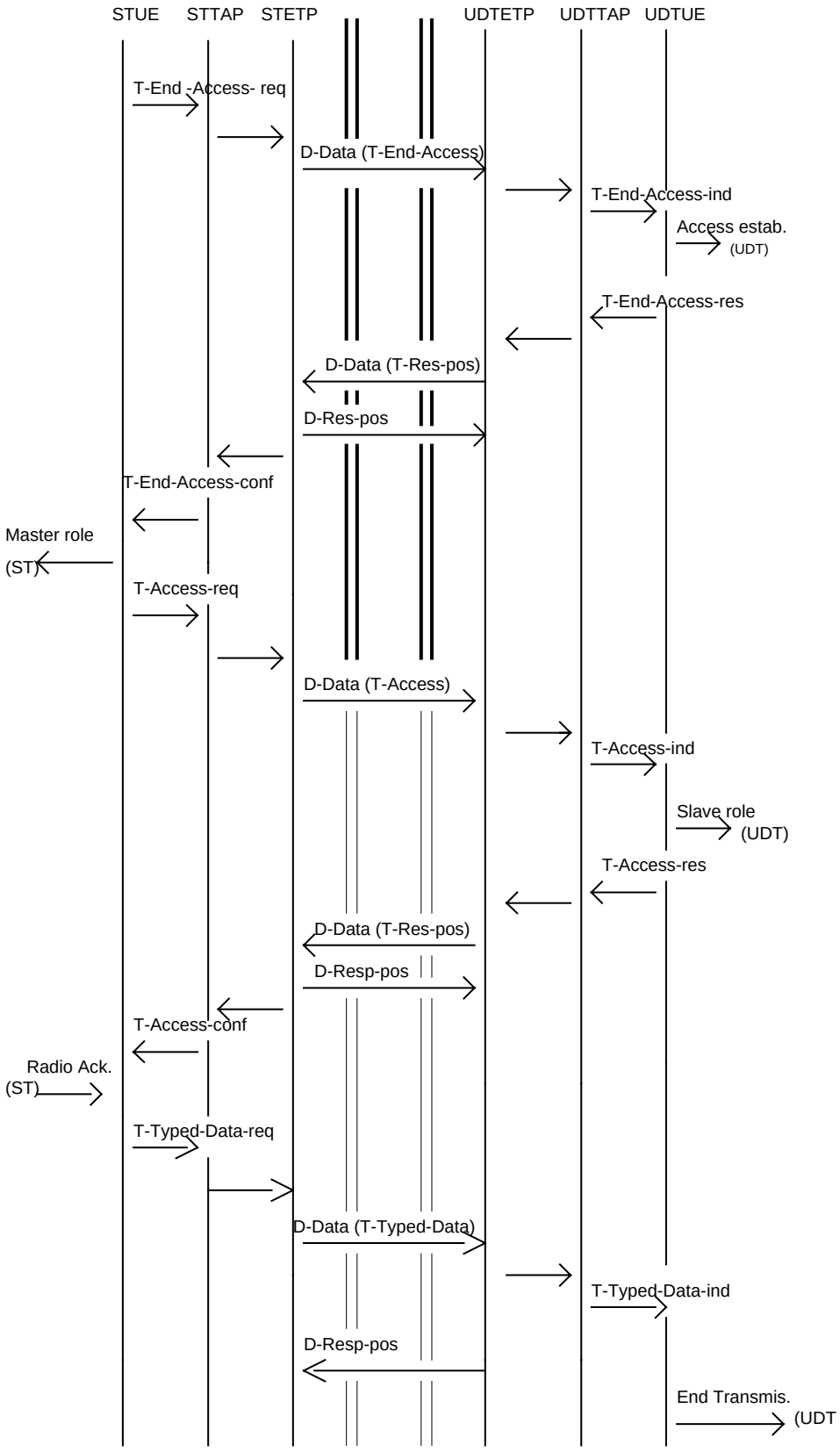

Figure 28: Uplink Message is transferred: ST Exchanges Roles UDT waits for radio transmission acknowledgement

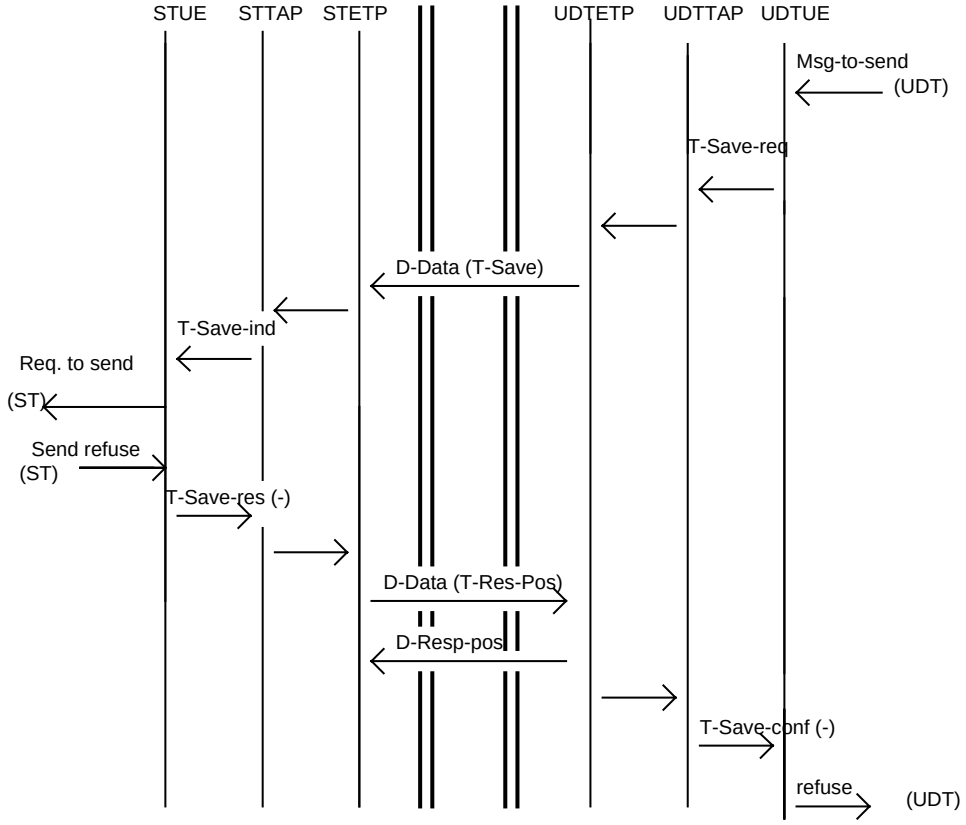

Figure 29: Transfer of uplink message denied by the ST

History

Document history		
Date	**Comment**	**Status**
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