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Part 12: Supplementary Services (SS) Stage 3;
Part 12-09: Access Priority (AP)**

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Foreword

This draft European Telecommunication Standard (ETS) has been produced by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

This ETS is a multi-part standard and will consist of the following parts:

- Part 1: "General network design".
- Part 2: "Air Interface (AI)".
- Part 3: "Inter-working", (DE/RES-06001-3).
- Part 4: "Gateways", (DE/RES-06001-4).
- Part 5: "Terminal equipment interface", (DE/RES-06001-5).
- Part 6: "Line connected stations", (DE/RES-06001-6).
- Part 7: "Security", (DE/RES-06001-7).
- Part 8: "Management services", (DE/RES-06001-8).
- Part 9: "Performance objectives", (DE/RES-06001-9).
- Part 10: "Supplementary Services (SS) Stage 1".
- Part 11: "Supplementary Services (SS) Stage 2".
- Part 12: "Supplementary Services (SS) Stage 3".**
- Part 13: "SDL Model of the Air Interface".
- Part 14: "PICS Proforma", (DE/RES-06001-14).
- Part 15: "Inter-working - Extended Operations", (DE/RES-06001-15).

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1 Scope

This ETS defines the stage 3 specifications of the Supplementary Service Access Priority (SS-AP) for the Trans-European Trunked Radio (TETRA).

The SS-AP enables a user to have preferential access to the TETRA system in times of radio link congestion. The SS-AP specifies the definition and interrogation of the Access Priority Level (APL) that the Mobile Station (MS) may apply for the random access in uplink direction in the air interface.

Man-Machine Interface (MMI) and charging principles are outside the scope of this ETS.

Supplementary service stage 3 specification is preceded by the stage 1 and the stage 2 specifications of the service. Stage 1 describes the functional capabilities from the user's point of view. Stage 2 defines the functional behaviour in terms of functional entities and information flows. Stage 3 gives a precise description of the supplementary service from the implementation point of view. It defines the protocols for the service and the encoding rules for the information flows. It defines the processes for the functional entities and their behaviour. The described protocols and behaviour apply for the Switching and Management Infrastructure (SwMI), for the MS and for the Line Station (LS) and can be applied over the Inter-System Interface (ISI) between TETRA systems.

2 Normative references

This ETS incorporates, by dated or 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] CCITT Recommendation I.130 (1988): "Method for the characterisation of telecommunication services supported by an ISSN and network capabilities of an ISDN".
- [2] ETS 300 392-2: "Radio Equipment and Systems (RES), Trans-European Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".
- [3] ETS 300 171: "Private Telecommunication Network (PTN); Specification, functional models and information; Control aspects of circuit mode basic services; ECMA-BCSD".
- [4] ETS 300 392-1: "Radio Equipment and Systems (RES), Trans-European Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design".
- [5] ETS 300 392-11-09: "Radio Equipment and Systems (RES), Trans-European Trunked Radio (TETRA); Voice plus Data (V+D); Part 11: Supplementary Services (SS) Stage 2; Part 11-09: Access Priority (AP)".
- [6] ITU-T Recommendation Z.100 (1993): "Specification and Description Language (SDL)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETS, the following definitions apply:

Access Priority Level (APL): A value allocated to each mobile ITSI or GTSI/call type. It is used for call related messages to determine priority access across the air interface to the control functional entities.

served user: The user making a request for service.

Switching And Management Infrastructure (SwMI): All of the TETRA equipment for a Voice plus Data (V+D) network except for subscriber terminals. The SwMI enables subscriber terminals to communicate with each other via the SwMI.

3.2 Abbreviations

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

AP	Access Priority
APL	Access Priority Level
CC	basic service Call Control functional entity
CCA	basic service Call Control functional entity Agent

NOTE 1: CC and CCA are applied as defined in ETS 300 171 [3].

GTSI	Group TETRA Subscriber Identity
FE	Functional Entity
ITSI	Individual TETRA Subscriber Identity
LS	Line Station
MS	Mobile Station
SDL	(Functional) Specification and Description Language
SS	Supplementary Service

NOTE 2: The abbreviation SS is only used when referring to a specific supplementary service.

SwMI	Switching and Management Infrastructure
TETRA	Trans-European Trunked RAdio

4 Supplementary Service Access Priority (SS-AP) stage 3 specification

4.1 Functional model

4.1.1 Functional model description

The functional model shall comprise the following Functional Entities (FEs):

- FE1 served user's functional entity;
- FE2 SS-AP functional entity in system 1;
- FE3 authorized user's service agent;
- FE4 SS-AP functional entity in system 2.

The following relationships shall exist between these FEs:

- ra between FE1 and FE2;
- rb between FE2 and FE4 in different TETRA systems;
- rc between FE2 and FE3;
- rd between FE1 and FE4;
- re between FE3 and FE4.

Figure 1 shows these FEs and the relationships for the management part. As the priority used for random access mechanism is used in the uplink but not explicitly sent over the air interface there are no supplementary service specific relationships for the operational part between FEs.

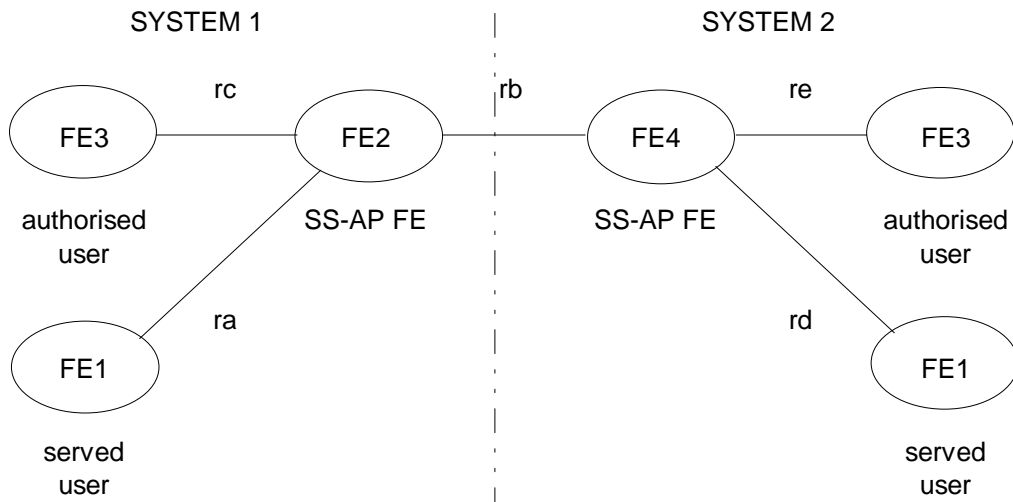


Figure 1: The relationships and functional entities of the management part of SS-AP

4.1.2 Relationship with a basic service

Functional entity FE1 is collocated with CCA as FE1 maps the correct APL value for the basic service.

4.2 Protocol structure and protocol stack

Figure 2 shows the position of the layer 3 SS sub-entity within the Circuit Mode Control Entity (CMCE) and the TNSS Service Access Point (TNSS-SAP) in both the MS/LS and in the SwMI protocol stack. The SS-AP specific definition and interrogation information elements shall be conveyed in a SS FACILITY element within the SS sub-entity. The FACILITY element is then conveyed in any suitable CMCE Packet Data Unit (PDU) (see ETS 300 392-2 [2] subclause 14.7) between the MS/LS and the SwMI or over the ISI. This ETS is only normative for the protocol architecture and user application SAPs within the MS/LS but gives an informative description of the protocol and the SAPs within the SwMI.

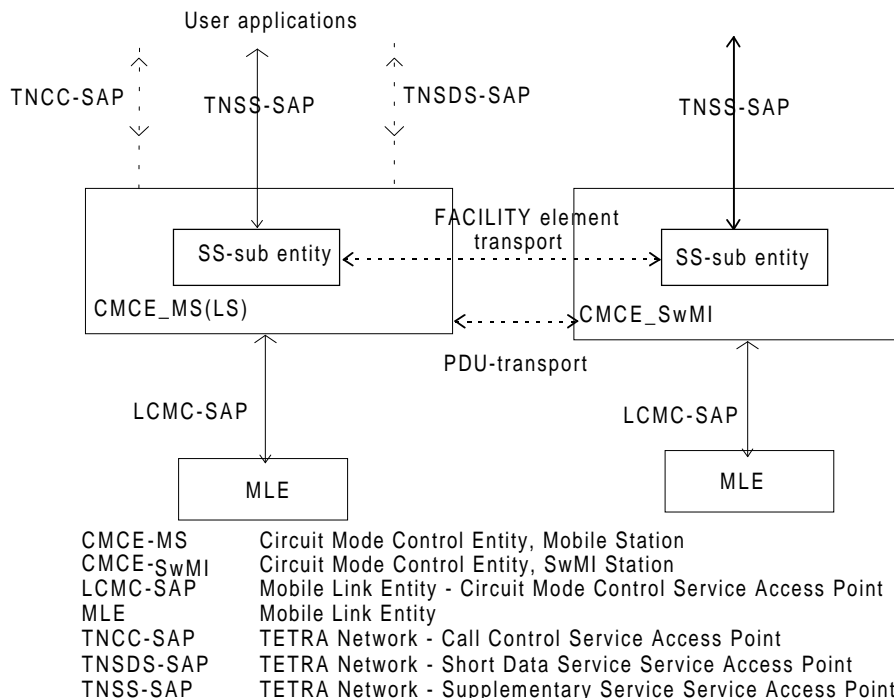


Figure 2: System view

5 SS-AP service description

5.1 General

This clause describes SS-AP specific services offered by the CMCE at the TNSS-SAP of the TETRA Voice plus Data (V+D) layer 3 service boundary. The specific SS-AP services shall be carried as arguments within the following 3 general generic SS primitives:

- a) TNSS-SERVICE;
- b) TNSS-INFO;
- c) TNSS-ERROR.

For a detailed description of the generic SS primitives refer to ETS 300 392-2 [2] subclause 12.3. The flow of the generic SS primitives shall be as illustrated in figure 3.

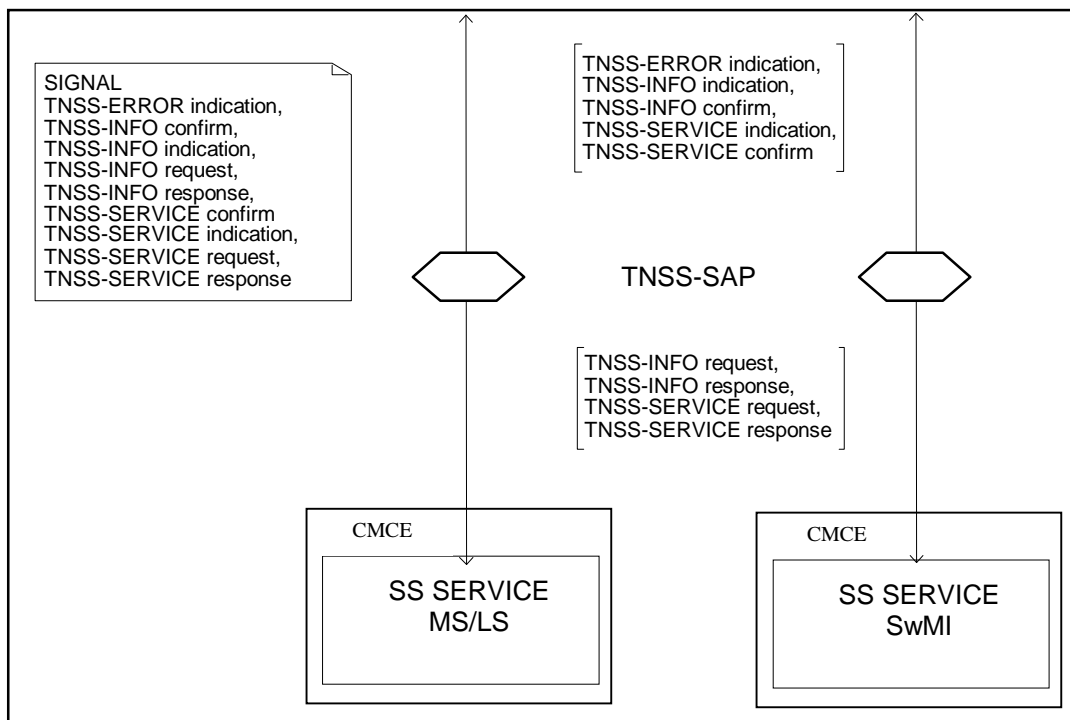


Figure 3: General supplementary services provided at the TNSS-SAP

The TNSS-SERVICE shall enable an invoking entity to request and to be informed about, an operation to be performed by the performing entity.

The TNSS-INFO shall enable an entity to be informed of ongoing transactions.

The TNSS-ERROR shall enable a performing entity to return the negative reply of a unsuccessfully performed operation to the invoking entity.

5.1.1 SS-AP services offered over the TNSS-SAP

5.1.1.1 SS-AP primitives

The primitives shall as operation argument contain the following SS-AP sub-arguments.

- a) DEFINE1 request;
- b) DEFINE1-ACK confirm;

- c) DEFINE2 indication;
- d) INTERROGATE request;
- e) INTERROGATE-ACK confirm.

The information contained in the following argument description tables correspond to the following key:

- C/O/M: conditional/optional/mandatory
- Remark: comment

5.1.1.2 DEFINE1 request

DEFINE1 request primitive shall be offered from application to FE3 over TNSS-SAP. The primitive shall contain the SS-AP information elements listed in table 1.

If the defined subscriber number is repeated, the definition(s) shall apply to all listed subscriber numbers.

The element defined subscriber number shall be repeated if this is indicated in the element defined subscriber type. If repeated, it should be interpreted as a range of numbers or as a list of numbers according to defined subscriber type. A list can contain up to ten numbers; with a range the first and last number of the range is given.

If the basic service type appears several times, the APL for low and APL for high that follow basic service type elements should apply to all preceding basic service types, e.g. the APL for low/high is defined to two basic service types if the following elements appear in DEFINE1:

- basic service type₁ + basic service type₂ + APL for low₁ + APL for high₁.

The combinations of elements basic service type, APL for low and APL for high can appear several times in DEFINE1 in order to allow different APL value definitions for different basic service types, e.g. the elements can appear in the following way:

- basic service type₁ + APL for low₁ + APL for high₁;
- basic service type₂ + APL for low₂ + APL for high₂.

The element basic service type can be repeated within the combinations.

The elements APL for low and APL for high can only appear once after the element basic service type(s). However, they can appear several times in one DEFINE1 primitive, if they make an element combination with basic service type(s).

Table 1: DEFINE1 request

Element	C/O/M	Remark
SS type	M	:= SS-AP
SS-AP message type	M	:= definition
Defined subscriber type	M	
Defined subscriber number	M	repeatable
Basic service type(s)	M	repeatable
APL for low priority	M	note 1, note 2
APL for high priority	M	note 1, note 2
NOTE 1:	The priority in set-up message shall be -2 compared to alert, connect and Tx-demand (if the priority has the value of 2 or more). The priority in call request is -2 compared to call accepted, interrupt and unit-data.	
NOTE 2:	"APL for low priority" corresponds to AP value "low"; "APL for high priority" corresponds to AP value "high", as defined in ETS 300 392-2 [2]. FE1 assigns the PDU priority depending on if the application requested "low" or "high" AP. If emergency priority was requested, the PDU priority is assigned the emergency value.	

5.1.1.3 DEFINE1-ACK confirm

DEFINE1-ACK confirm primitive shall be offered from FE3 to application over TNSS-SAP. The primitive shall contain the SS-AP information elements listed in table 2.

If the defined subscriber type contains several subscriber numbers, the definition(s) shall apply to all listed subscriber numbers.

The element defined subscriber number shall be repeated if this is indicated in the element defined subscriber type. If repeated, it should be interpreted as a range of numbers or as a list of numbers according to defined subscriber type. A list can contain up to ten numbers; with a range the first and last number of the range is given.

The values for APL for low/high can be changed by FE2 (FE4), if the authorized user is not allowed the values, he sends in the definition request. If the values are changed, the new values shall be sent in DEFINE1-ACK to the authorized user. If the values are not changed, the APL for low/high elements are omitted from the primitive.

If the basic service type appears several times, the APL for low and APL for high that follow basic service type elements should apply to all preceding basic service types, e.g. the APL for low/high is defined to two basic service types if the following elements appear in DEFINE1:

- basic service type₁ + basic service type₂ + APL for low₁ + APL for high₁.

The combinations of elements basic service type, APL for low and APL for high can appear several times in DEFINE1 in order to allow different APL value definitions for different basic service types, e.g. the elements can appear in the following way:

- basic service type₁ + APL for low₁ + APL for high₁;
- basic service type₂ + APL for low₂ + APL for high₂.

The element basic service type can be repeated within the combinations.

NOTE: If the acknowledgements are different for different "Defined subscriber numbers" FE3 delivers several DEFINE1-ACK primitives to application.

Table 2: DEFINE1-ACK confirm

Element	C/O/M	Remark
SS type	M	:= SS-AP
SS-AP message type	M	:= definition
Defined subscriber type	M	
Defined subscriber number	M	repeatable
Result for definition	M	
APL for low priority	C	
APL for high priority	C	

5.1.1.4 DEFINE2 indication

DEFINE2 indication primitive shall be offered from FE1 to application over TNSS-SAP if FE1 made the definition. FE1 should make the definition, if possible. The primitive shall contain the SS-AP information elements listed in table 3.

If the defined subscriber type contains several subscriber numbers, the definition(s) shall apply to all listed subscriber numbers.

The element defined subscriber number shall be repeated if this is indicated in the element defined subscriber type. If repeated, it should be interpreted as a range of numbers or as a list of numbers according to defined subscriber type. A list can contain up to ten numbers; with a range the first and last number of the range is given.

If the basic service type appears several times, the APL for low and APL for high that follow basic service type elements should apply to all preceding basic service types, e.g. the APL for low/high is defined to two basic service types if the following elements appear in DEFINE2:

- basic service type₁ + basic service type₂ + APL for low₁ + APL for high₁.

The combinations of elements basic service type, APL for low and APL for high can appear several times in DEFINE2 in order to allow different APL value definitions for different basic service types, e.g. the elements can appear in the following way:

- basic service type₁ + APL for low₁ + APL for high₁;
- basic service type₂ + APL for low₂ + APL for high₂.

The element basic service type can be repeated within the combinations.

The elements APL for low and APL for high can only appear once after the element basic service type(s). However, they can appear several times in one DEFINE2 primitive, if they make an element combination with basic service type(s).

Table 3: DEFINE2 indication

Element	C/O/M	Remark
SS type	M	:= SS-AP
SS-AP message type	M	:= activation
Defined subscriber type	M	
Defined subscriber number	M	repeatable
Basic service type(s)	M	repeatable
APL for low priority	M	note 1, note 2
APL for high priority	M	note 1, note 2
NOTE 1:	The priority in set-up message is -2 compared to alert, connect and Tx-demand (if the priority has the value of 2 or more). The priority in call request is -2 compared to call accepted, interrupt and unit-data.	
NOTE 2:	"APL for low priority" corresponds to AP value "low"; "APL for high priority" corresponds to AP value "high", as defined in ETS 300 392-2 [2]. FE1 shall assign the PDU priority depending on if the application requested "low" or "high" AP. If emergency priority was requested, the PDU priority is assigned the emergency value.	

5.1.1.5 INTERROGATE request

INTERROGATE request primitive shall be offered from application to FE3 over TNSS-SAP when the authorized user makes an interrogation request. INTERROGATE primitive shall contain the SS-AP information elements listed in table 4.

This interrogated subscriber number shall be repeated if this is indicated in interrogated subscriber number. If repeated, it should be interpreted as a range of numbers or as a list of numbers according to interrogated subscriber type. A list can contain up to ten numbers; with a range the first and last number of the range is given.

Table 4: INTERROGATE request

Element	C/O/M	Remark
SS type	M	:= SS-AP
SS-AP message type	M	:= interrogation
Interrogated subscriber type	M	
Interrogated subscriber number	M	repeated

5.1.1.6 INTERROGATE-ACK confirm

INTERROGATE-ACK confirm primitive shall be offered from FE3 to application over TNSS-SAP as a response to a previously sent interrogation request. INTERROGATE-ACK primitive shall contain the SS-AP information elements listed in table 5.

If the interrogated subscriber type contains several subscriber numbers, the definition(s) shall apply to all listed subscriber numbers.

If the basic service type appears several times, the APL for low and APL for high that follow basic service type elements should apply to all preceding basic service types, e.g. the APL for low/high is defined to two basic service types if the following elements appear in DEFINE1:

- basic service type₁ + basic service type₂ + APL for low₁ + APL for high₁.

The combinations of elements basic service type, APL for low and APL for high can appear several times in INTERROGATE in order to show different APL value definitions for different basic service types, e.g. the elements can appear in the following way:

- basic service type₁ + APL for low₁ + APL for high₁;
- basic service type₂ + APL for low₂ + APL for high₂.

The element basic service type can be repeated within the combinations.

The elements APL for low and APL for high can only appear once after the element basic service type(s). However, they can appear several times in one INTERROGATE-ACK primitive, if they make an element combination with basic service type(s).

NOTE: If definitions/responses are different for different "interrogated subscriber numbers" FE3 sends several INTERROGATE-ACK primitives to application.

Table 5: INTERROGATE-ACK confirm

Element	C/O/M	Remark
SS type	M	:= SS-AP
SS-AP message type	M	:= interrogation
Interrogated subscriber type	M	
Interrogated subscriber number	M	repeatable
Result for interrogation	M	
Basic service type(s)	C	repeatable, note 1
APL for low priority	C	note 1, note 2, note 3
APL for high priority	C	note 1, note 2, note 3
NOTE 1:	The element appears only if the "result for interrogation" has the value "accepted" or "accepted but request to one or more served users still pending in SwMI".	
NOTE 2:	The priority in set-up message is -2 compared to alert, connect and Tx-demand (if the priority has the value of 2 or more). The priority in call request is -2 compared to call accepted, interrupt and unit-data.	
NOTE 3:	"APL for low priority" corresponds to AP value "low"; "APL for high priority" corresponds to AP value "high", as defined in ETS 300 392-2 [2].	

5.1.1.7 Primitive descriptions

APL for low/high priority =

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7 (Emergency)

basic service type(s) =

1	all basic services
2	circuit mode speech
3	circuit mode data
4	packet mode data (connection oriented)
5	packet mode data (connectionless)
6	Short Data Service (SDS)
7	SDS status

defined subscriber number =

TETRA Subscriber Identity (TSI) = Short Subscriber Identity (SSI) + Mobile Country Code (MCC) + Mobile Network Code (MNC) (see ETS 300 392-1 [4], clause 7).

defined subscriber type =

- 0 subscriber number, 1 subscriber number following
- 1 range of numbers, 2 subscriber numbers following
- 2 list of subscriber numbers, 2 subscriber numbers following
- 3 list of subscriber numbers, 3 subscriber numbers following
- 4 list of subscriber numbers, 4 subscriber numbers following
- 5 list of subscriber numbers, 5 subscriber numbers following
- 6 list of subscriber numbers, 6 subscriber numbers following
- 7 list of subscriber numbers, 7 subscriber numbers following
- 8 list of subscriber numbers, 8 subscriber numbers following
- 9 list of subscriber numbers, 9 subscriber numbers following
- 10 list of subscriber numbers, 10 subscriber numbers following

interrogated subscriber number, see defined subscriber number.

interrogated subscriber type, see defined subscriber type.

result for definition =

- 0 accepted by SwMI (from FE3 to application)/ accepted by MS (from FE1 to application)
- 1 accepted but APL values changed
- 2 one or more served users could not accept the request/one or more Served users where not reached
- 3 request failed for any reason
- 4 user not authorized
- 5 unknown TETRA identity
- 6 parameters not valid
- 7 insufficient information

result for interrogation =

- 0 accepted
- 1 accepted but request to one or more served users pending in SwMI
- 2 one or more served users could not accept the request/one or more served users where not reached
- 3 APL not defined for the given identity
- 4 request failed for any reason
- 5 user not authorized
- 6 unknown TETRA identity
- 7 parameters not valid

5.1.2 Mapping of SS-AP primitives to TNSS primitives

SS-AP primitives shall be mapped by Functional Entities (FEs) to TNSS-SERVICE, TNSS-INFO and TNSS-ERROR primitives according to table 6.

Table 6: Mapping of the SS-AP primitives to TNSS primitives

SS-AP Primitive	TNSS-SERVICE request	TNSS-SERVICE confirm	TNSS-INFO indication	TNSS-ERROR indication	Remark
DEFINE1	in FE3	-	-	-	
DEFINE1-ACK	-	with successful definition in FE3	-	with unsuccessful definition in FE3	note 1
DEFINE2	-	-	with successful definition in FE1	-	note 2
INTERROGATE	in FE3/FE1	-	-	-	
INTERROGATE-ACK	-	with successful interrogation in FE3/FE1	-	with unsuccessful interrogation in FE3/FE1	note 3
NOTE 1:	For this purpose the definition shall be considered successful if the value for "Result for definition" is "accepted by SwMI/ accepted by MS", "accepted but request to one or more served users pending in SwMI", "one or more served users could not accept the request/one or more served users where not reached".				
NOTE 2:	Definition shall be considered successful if FE1 saved it to the database in MS/LS.				
NOTE 3:	For this purpose the interrogation shall be considered successful if the value for "Result for interrogation" is "accepted" or "accepted but definition request to one or more served users pending in SwMI".				

6 SS-AP protocol description

6.1 Overview

Figure 4 shows the position of the SS sub-entity within the layer 3 of the MS/LS protocol stack.

NOTE: Internal communication between the Call Control (CC) process and the SS process is outside the scope of this ETS.

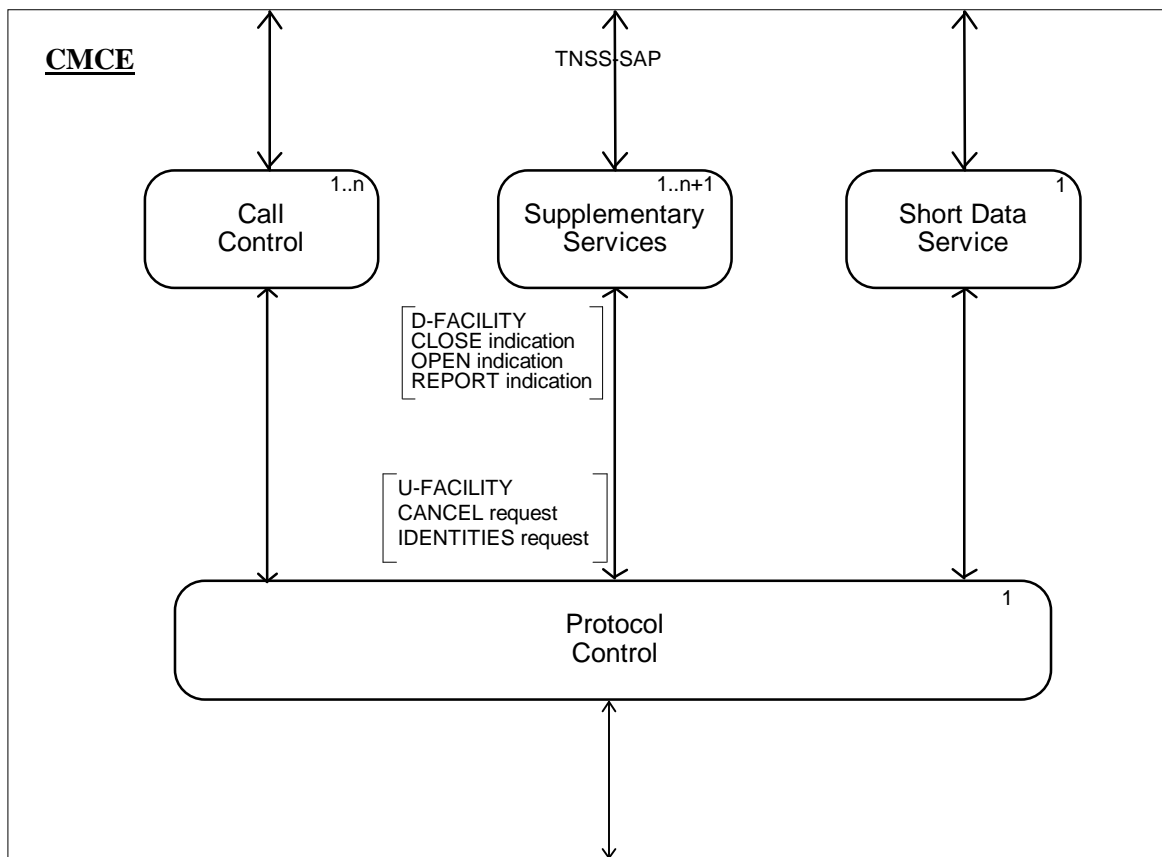


Figure 4: Block view of CMCE for MS/LS

6.2 SS-AP protocol states

The normal SS-AP protocol states are described below.

6.2.1 Protocol states of FE1

6.2.1.1 State IDLE

IDLE shall be the normal state of FE1. In this state FE1 shall receive the definition requests concerning its own identity or a group which the user is a member of from FE2/FE4. FE1 shall save the definitions to the database in the MS, if possible. FE1 shall send an indication of the definition to the application in MS and an acknowledgement back to FE2/FE4. If FE1 can not save the definition, it indicates that to FE2/FE4 in the acknowledgement. The definition shall be applied from the moment the definition is made.

6.2.2 Protocol states of FE2

6.2.2.1 State IDLE

IDLE should be the normal state of FE2. In this state FE2 receives the definition or interrogation requests from FE3. FE2 should verify the received definition or interrogation request. In case of interrogation, if FE2 finds no reason to bar the interrogation request, FE2 should fetch the interrogated data and send it to FE3. In case of definition request, FE2 should send the definition acknowledgement to FE3. If FE2 accepted the definition request, FE2 should start timer T1 to supervise the sending of definition requests to FE1(s), send the request(s) to FE1(s) and move to WAIT-FOR-ACK state.

6.2.2.2 State WAIT-FOR-ACK

In WAIT-FOR-ACK state FE2 should wait for the response(s) from FE1(s). When FE1(s) has (have) acknowledged the request or if the timer T1 expires, FE2 should return to state IDLE.

NOTE: As an operator option, FE2 may keep the definition requests pending in SwMI for FE1(s) and send them later, if one or more FE1s cannot be reached or has (have) not acknowledged the request.

6.2.3 Protocol states of FE3

6.2.3.1 State IDLE

IDLE shall be the normal state of FE3. In this state FE3 shall receive the definition or interrogation requests from the user. FE3 shall verify the requests and if it finds no reason to bar them, FE3 shall send them to FE2. If FE3 bars the request, it shall send an acknowledgement to the application.

In IDLE state FE3 shall also receive the acknowledgements and responses for the definition or interrogation requests. At the reception of these information flows, FE3 shall send them to the application.

6.2.4 Protocol states of FE4

6.2.4.1 State IDLE

IDLE should be the normal and only state of FE4. In this state FE4 should receive the definition and interrogation information flows from FE3 to be delivered to FE2 in another system. And, FE4 should also receive the information flows from FE2 to be delivered to FE1 or FE3 located in this system.

6.3 Procedures

The normal SS-AP procedures are described below.

6.3.1 Procedures for FE1

6.3.1.1 Definition in FE1

At the reception of SS-AP definition request, FE1 shall save the SS-AP definition to the database in the MS, if possible. FE1 shall also send an acknowledgement to FE2 indicating whether the request was made or if the request failed. If the definition was made, FE1 shall also send an indication to the user application in order to it display the definition to the user.

If a definition is requested for a subscriber number range or a list of subscriber numbers, the "Result for definition" can be different for different subscriber numbers. In that case, FE1 shall send separate acknowledgements (PDUs or FACILITY elements) to FE2. FE1 should accept the definition request received from FE2, if possible.

The definition shall be applied from the moment it is made.

6.3.2 Procedures for FE2

6.3.2.1 Verification in FE2

At the reception of SS-AP definition or interrogation request, FE2 should verify that the request is authorized and that the parameters are in the correct range. After making the checks, FE2 either continues to carry out the request, or rejects it.

If a definition is requested for a subscriber number range or a list of subscriber numbers, the "Result for definition" can be different for different subscriber numbers. In that case, FE2 should send separate acknowledgements (FACILITY elements) to FE3. If e.g. the user has requested the definition for a list of two subscriber numbers, and the request is accepted for one subscriber number but the request is rejected for the other, FE2 should send two separate acknowledgements back to FE3.

Annex A shows examples of DEFINE1-ACK SS-FACILITY element contents.

The definition should be applied from the moment it is made.

6.3.2.2 Definition in FE2

FE2 locates the FE1(s), makes the definition to the SwMI and the definition request(s) to FE1(s).

FE2 should construct the SS-AP definition (DEFINE2) PDU for served users according to the user's request. FE2 may, however, change the APL values if authorized user has defined values he is not allowed to define. The definition can be made to:

- one subscriber or group number;
- a list of subscriber or group numbers;
- a range of subscriber or group numbers.

The APL can be defined different values for different basic services.

Annex A shows an example of a DEFINE2 SS-FACILITY element contents.

Served subscribers (FE1s) should acknowledge the definition request with DEFINE2-ACK.

6.3.2.3 Interrogation in FE2

FE2 should fetch the interrogated data in order to send it to FE3.

FE2 should construct the SS-AP interrogation (INTERROGATE) elements for authorized user according to the user's request. The user can interrogate the defined APL value for low and high of:

- one subscriber or group number;
- a list of subscriber or group numbers;
- a range of subscriber or group numbers.

The APL can be assigned different values for different basic services. All defined values should be included in the INTERROGATE-ACK.

Annex A shows an example of a INTERROGATE SS-FACILITY element contents.

If the user has interrogated the SS-AP for a subscriber number range or list, and if any of the parameters listed below are different for any of these numbers, FE2 should send separate INTERROGATE-ACK flows to FE3:

- result for interrogation;
- number of basic service definitions;
- number of basic services;
- basic services;
- APL for low priority;
- APL for high priority.

6.3.3 Procedures for FE3

6.3.3.1 Verification in FE3

At the reception of SS-AP definition or interrogation request from user application, FE3 shall verify the parameters and if it finds them suitable, it shall produce the definition/interrogation request according to request received from application. FE3 shall make the PDUs according to the descriptions in subclauses 6.5 and 6.6. FE3 shall send the definition/interrogation request to FE2. If FE3 barred the definition locally, FE3 shall send an indication to the user application.

FE3 shall construct the SS-AP definition (DEFINE1) SS-FACILITY element according to the user's request. The definition can be made to:

- one subscriber or group number;
- a list of subscriber or group numbers;
- a range of subscriber or group numbers.

The authorized user can define different APL values for different basic services.

Annex A shows an example of a DEFINE1 SS-FACILITY element contents.

FE3 shall construct the SS-AP interrogation (INTERROGATE) SS-FACILITY element for authorized user according to the user's request. The user can interrogate the defined APL for low and high of:

- one subscriber or group number;
- a list of subscriber or group numbers;
- a range of subscriber or group numbers.

6.3.4 Procedures for FE4

6.3.4.1 Routing address in FE4

If FE4 receives any information flow, that should be routed over the ISI to another TETRA system, FE4 adds the routing address to the request. If FE4 receives any information flow from another TETRA system over the ISI, FE4 should deliver the request to FE1/FE3 located in the same system as FE4.

FE4 can change or define APL values for the subscribers that have migrated to the system where FE4 is located. When FE4 receives DEFINE2 information flows to be delivered to served users, FE4 can change the APL values for migrated subscribers. FE4 can also define APL values for the subscribers that have migrated to the system with DEFINE2 information flow.

The definition should be applied from the moment it is made.

6.4 Protocol timers

6.4.1 Protocol timers for FE2

FE2 should use timer T1 to supervise the time it waits for acknowledgements from FE1(s) after FE2 has sent the definition requests to FE1(s).

6.5 PDU Descriptions

The SS-FACILITY element which shall be used to convey the supplementary service information to and from MS/LS and over the ISI can be transported in any CC PDU if inside a call or in a D/U-FACILITY or D/U-FACILITY PDU if the information is call-unrelated. The element coding used is in accordance with the general rules specified in ETS 300 392-2 [2], clause 14.

The specific SS-FACILITY element coding independently of bearer PDU for SS-AP is detailed in the following clauses.

The information contained in the following argument description tables correspond to the following key:

- Length: length of the sub-argument in bits;
- Type: element type (1, 2 or 3) described in ETS 300 392-2 [2];
- C/O/M: conditional/optional/mandatory;
- Remark: comment.

NOTE: The elements that follow the "Defined/Interrogated subscriber numbers" in the PDU shall be valid for all the given "Defined/Interrogated subscriber numbers".

6.5.1 DEFINE1

DEFINE1 information flow shall be sent from FE3 to FE2. The flow shall be offered from FE3 to FE4 only if FE3 is in another TETRA system.

DEFINE1 shall contain the SS-AP information elements listed in table 7.

Table 7: DEFINE1 PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= AP := 000011 ₂
Action type	4	1	M		:= definition := 0011 ₂
Defined subscriber type	4	1	M		
Defined subscriber number	48	1	C		note
Number of basic service definitions	3	1	M		
Number of basic services	3	1	C		note
Basic service(s)	3	1	C		note
APL for low priority	3	1	M		
APL for high priority	3	1	M		
NOTE:	Element shall be repeatable and it shall appear at least once.				

6.5.2 DEFINE1-ACK

DEFINE ack information flow shall be offered from FE2 to FE3. The flow shall be offered from FE4 to FE2 only if FE3 is in another TETRA system.

NOTE: If the acknowledgements are different for different "Defined subscriber numbers" FE2 shall send several DEFINE1-ACKs to FE2 (FE4).

DEFINE1-ACK shall contain the SS-AP information elements listed in table 8.

Table 8: DEFINE1-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= AP := 000011 ₂
Action type	4	1	M		:= definition := 0011 ₂
Defined subscriber type	4	1	M		
Defined subscriber number	48	1	C		note
Result for definition	3	1	M		
Number of basic service definitions	3	1	C		
Number of basic services	3	1	C		note
Basic service(s)	3	1	C		note
APL for low priority	3	1	C		
APL for high priority	3	1	C		
NOTE: Element shall be repeatable and it shall appear at least once.					

6.5.3 DEFINE2

DEFINE2 information flow shall be offered from FE2 to FE1. The flow shall be offered from FE2 to FE4 only if FE1 is in another TETRA system. The flow can be offered from FE4 to FE1, if Visited TETRA system defines SS-AP to migrated subscribers.

DEFINE2 shall contain the SS-AP information elements listed in table 9.

Table 9: DEFINE2 PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= AP := 000011 ₂
Action type	4	1	M		:= activation := 0001 ₂
Defined subscriber type	4	1	M		
Defined subscriber number	48	1	C		note
Number of basic service definitions	3	1	M		
Number of basic services	3	1	C		note
Basic service(s)	3	1	C		note
APL for low priority	3	1	M		
APL for high priority	3	1	M		
NOTE: Element shall be repeatable and it shall appear at least once.					

6.5.4 DEFINE2-ACK

DEFINE2-ACK information flow shall be offered from FE1 to FE2. The flow shall be offered from FE1 to FE4 only if FE1 is in another TETRA system. The flow can be offered from FE1 to FE4, if Visited TETRA system defines SS-AP to migrated subscribers.

The Result shall be valid for all the Defined subscriber numbers listed in the primitive

NOTE: If the acknowledgements are different for different "Defined subscriber numbers" FE1 sends several DEFINE2-ACKs to FE2.

DEFINE2-ACK shall contain the SS-AP information elements listed in table 10.

Table 10: DEFINE2-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= AP := 000011 ₂
Action type	4	1	M		:= activation := 0001 ₂
Defined subscriber type	4	1	M		
Defined subscriber number	48	1	C		note
Result for definition	3	1	M		
NOTE: Element shall be repeatable and it shall appear at least once.					

6.5.5 INTERROGATE

INTERROGATE information flow shall be offered from FE3 to FE2. The flow shall be offered from FE3 to FE4 only if FE3 is in another TETRA system.

INTERROGATE shall contain the SS-AP information elements listed in table 11.

Table 11: INTERROGATE PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= AP := 000011 ₂
Action type	4	1	M		:= interrogation := 0101 ₂
Interrogated subscriber type	4	1	M		
Interrogated subscriber number	48	1	C		note
NOTE: Element shall appear at least once.					

6.5.6 INTERROGATE-ACK

INTERROGATE-ACK information flow is offered from FE2 to FE3. The flow is offered from FE2 to FE4 only if FE3 in another TETRA system.

NOTE: If definitions/responses are different for different "Interrogated subscriber numbers" FE2 sends several INTERROGATE-ACKs to FE3.

INTERROGATE-ACK shall contain the SS-AP information elements listed in table 12.

Table 12: INTERROGATE-ACK PDU contents

Element	Length	Type	C/O/M	Value	Remark
SS-type	6	1	M		:= AP := 000011 ₂
Action type	4	1	M		:= interrogation := 0101 ₂
Interrogated subscriber type	4	1	M		
Interrogated subscriber number	48	1	C		note 1
Result for interrogation	3	1	M		
Number of basic service definitions	3	1	C		note 2
Number of basic services	3	1	C		note 1, note 2
Basic service(s)	3	1	C		note 1, note 2
APL for low priority	3	1	C		note 2
APL for high priority	3	1	C		note 2
NOTE 1: Element shall be repeatable and it shall appear at least once.					
NOTE 2: The elements following the element "Result for interrogation" can be present only if the result is "Accepted", "accepted but definition request to one or more served users pending in SwMI" or "accepted, but one or more served users could not accept the request/accepted, but one or more served users where not reached".					

6.6 Element coding

6.6.1 Action type

Action type shall indicate the type of the action as described in table 13. With SS-AP only activation, definition and interrogation is used.

NOTE: Activation is used for PDUs used with SS-AP definition and acknowledgement of definition to served user (DEFINE2, DEFINE2-ACK).

Table 13: Action type contents

Element	Length	Value	Remark
Action type	4	0000 ₂	SS not supported
		0001 ₂	Activation
		0010 ₂	Deactivation
		0011 ₂	Definition
		0100 ₂	Registration
		0101 ₂	Interrogation
		0110 ₂	Cancellation
		0111 ₂	Invocation
		1000 ₂	Information
		1001 ₂	Operation
		1010 ₂	Reserved
		...	etc.
		1111 ₂	Reserved

6.6.2 APL for low/high priority

APL for low/high priority shall indicate the numeric value for the APL.

The priority in set-up message shall be -2 compared to alert, connect and Tx-demand (if the priority shall have the value of 2 or more). The priority in call request shall be -2 compared to call accepted, interrupt and unit-data.

"APL for low priority" shall correspond to AP value "low"; "APL for high priority" corresponds to AP value "high", as defined in ETS 300 392-2 [2]. FE1 shall assign the PDU priority depending on if the application requested "low" or "high" AP. If emergency priority was requested, the PDU priority shall be assigned the emergency value.

APL for low/high priority element is described in table 14.

Table 14: APL for low/high priority contents

Element	Length	Value	Remarks
APL for low/high priority	3	000 ₂	0
		001 ₂	1
		010 ₂	2
		011 ₂	3
		100 ₂	4
		101 ₂	5
		110 ₂	6
		111 ₂	7 (Emergency)

6.6.3 Basic service(s)

Basic service(s) shall indicate the basic service(s) to which the following low and high APL values are defined. Basic service type(s) element is described in table 15.

Table 15: Basic service type(s) contents

Element	Length	Value	Remarks
Basic service(s)	3	000 ₂	all basic services
		001 ₂	circuit mode speech
		010 ₂	circuit mode data
		011 ₂	packet mode data (connection oriented)
		100 ₂	packet mode data (connectionless)
		101 ₂	SDS
		110 ₂	SDS (status)
		111 ₂	- (not used)

6.6.4 Defined subscriber number

Subscriber number shall define a TETRA subscriber identity. Subscriber number element is described in table 16.

Table 16: Subscriber number contents

Element	Length	Value	Remark
Short Subscriber Identity (SSI)	24		See ETS 300 392-1 [4] clause 7.
Mobile Country Code (MCC)	10		See ETS 300 392-1 [4] clause 7.
Mobile Network Code (MNC)	14		See ETS 300 392-1 [4] clause 7.

6.6.5 Defined subscriber type

Defined subscriber type shall indicate if following subscriber number or numbers shall be one number, range of number or a list of these numbers. The element shall also indicate how many "Defined subscriber number" elements is following. Defined subscriber type element is described in table 17.

Table 17: Defined subscriber type contents

Element	Length	Value	Remarks
Defined subscriber type	4	0000 ₂	Subscriber number, 1
		0001 ₂	Range of subscriber numbers, 2
		0010 ₂	List of subscriber numbers, 2
		0011 ₂	List of subscriber numbers, 3
		0100 ₂	List of subscriber numbers, 4
		0101 ₂	List of subscriber numbers, 5
		0110 ₂	List of subscriber numbers, 6
		0111 ₂	List of subscriber numbers, 7
		1000 ₂	List of subscriber numbers, 8
		1001 ₂	List of subscriber numbers, 9
		1010 ₂	List of subscriber numbers, 10
		1011 ₂	- (not used)
		...	etc.
1111 ₂	- (not used)		
NOTE: The number in the remarks column indicates how many subscriber number elements shall be present.			

6.6.6 Interrogated subscriber number

See defined subscriber number.

6.6.7 Interrogated subscriber type

See defined subscriber type.

6.6.8 Number of basic service(s)

Basic service type shall indicate how many basic service elements are present and follow this element in the PDU. Basic service type(s) element is described in table 18.

Table 18: Basic service type(s) contents

Element	Length	Value	Remarks
Number of basic service(s)	3	000 ₂	1
		001 ₂	2
		010 ₂	3
		011 ₂	4
		100 ₂	5
		101 ₂	6
		110 ₂	-
		111 ₂	-

6.6.9 Number of basic service definitions

Number of different basic service definitions shall indicate how many different basic service definitions are present in the SS-FACILITY element. One "different basic service" element refers to a combination of number of basic service(s), basic service(s), APL for low priority and APL for high priority. If the "Number of basic service definitions" has e.g. the value 2, there are two different combinations of number of basic services, basic services, APL for low priority and APL for high priority. Each element shall be present at least once in one combination, and the elements shall always be in the same order, e.g. first all elements of combination₁ (number of basic services₁ + basic services₁ + APL for low priority₁ + APL for high priority₁) and then all elements of combination₂ (number of basic services₂ + basic services₂ + APL for low priority₂ + APL for high priority₂).

Number of basic service(s) element is described in table 19.

Table 19: Number of basic service(s) contents

Element	Length	Value	Remarks
Number of different basic service(s) definitions	3	000 ₂	1
		001 ₂	2
		010 ₂	3
		011 ₂	4
		100 ₂	5
		101 ₂	6
		110 ₂	-
		111 ₂	-

6.6.10 Result for definition

Result for definition shall indicate whether the previously made definition request was successful or unsuccessful. Result for definition element is described in table 20.

Table 20: Result for definition contents

Element	Length	Value	Remark
Result for definition	3	000 ₂	accepted by SwMI or accepted by MS (note 1)
		001 ₂	accepted but APL values changed (note 2)
		010 ₂	one or more served users could not accept the request/one or more served users where not reached (note 2)
		011 ₂	request failed for any reason
		100 ₂	user not authorized
		101 ₂	unknown TETRA identity
		110 ₂	parameters not valid
		111 ₂	insufficient information
NOTE 1: "accepted by SwMI" can be applied only for DEFINE1-ACK; "accepted by MS" can be applied only for DEFINE2-ACK.			
NOTE 2: The error code is applicable only to flows from FE2 (or FE4) to FE3.			

6.6.11 Result for interrogation

Result for interrogation shall indicate whether the previously made interrogation request was successful or unsuccessful. Result for interrogation element is described in table 21.

Table 21: Result for interrogation contents

Element	Length	Value	Remark
Result for interrogation	3	000 ₂	accepted
		001 ₂	accepted but definition request to one or more served users pending in SwMI
		010 ₂	accepted, but one or more served users could not accept the request/accepted, but one or more served users where not reached
		011 ₂	APL not defined for the given identity
		100 ₂	request failed for any reason
		101 ₂	user not authorized
		110 ₂	unknown TETRA identity
		111 ₂	parameters not valid

7 SS-AP Functional Entity (FE) behaviour

The figures contained in this clause are intended to illustrate typical SS-AP specific FE behaviour in terms of information flows sent and received.

The behaviour of each FE is shown using the Specification and Description Language (SDL), see ITU-T Recommendation. Z.100 [6]. Notice, however, that due to simplicity there are deviations from syntactical rules.

The convention used in figures 5 to 12 is that output signals to the left represent information flows towards the user and output signals to the right represents information flows towards the SwMI part of the AP function. Input signals from the left represent information from the user and input signals from the right represent information flows from the central part of the SwMI.

7.1 Behaviour of FE1

7.1.1 Service interaction for FE1 (SS entity in served user)

Service interaction for FE1 (SS entity in served user) is shown in figure 5.

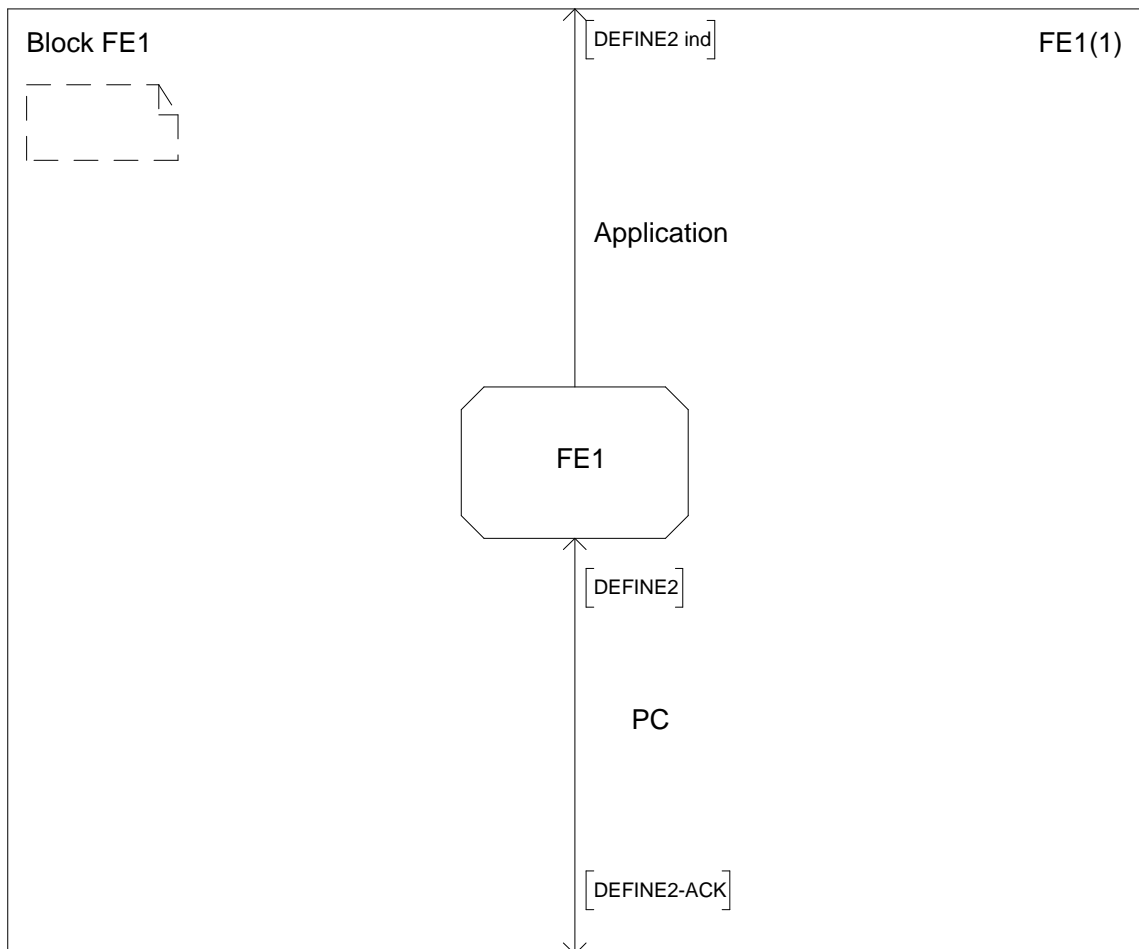


Figure 5: Service interaction for FE1

7.1.2 Process description of FE1 (SS entity in served user)

Process description of FE1 (SS entity in served user) is shown in figure 6.

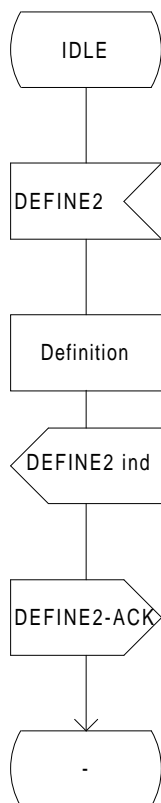


Figure 6: Process description of FE1

7.2 Behaviour of FE2

7.2.1 Service interaction for FE2 (SS entity in SwMI in system 1)

Service interaction for FE2 (SS entity in SwMI in system 1) is shown in figure 7.

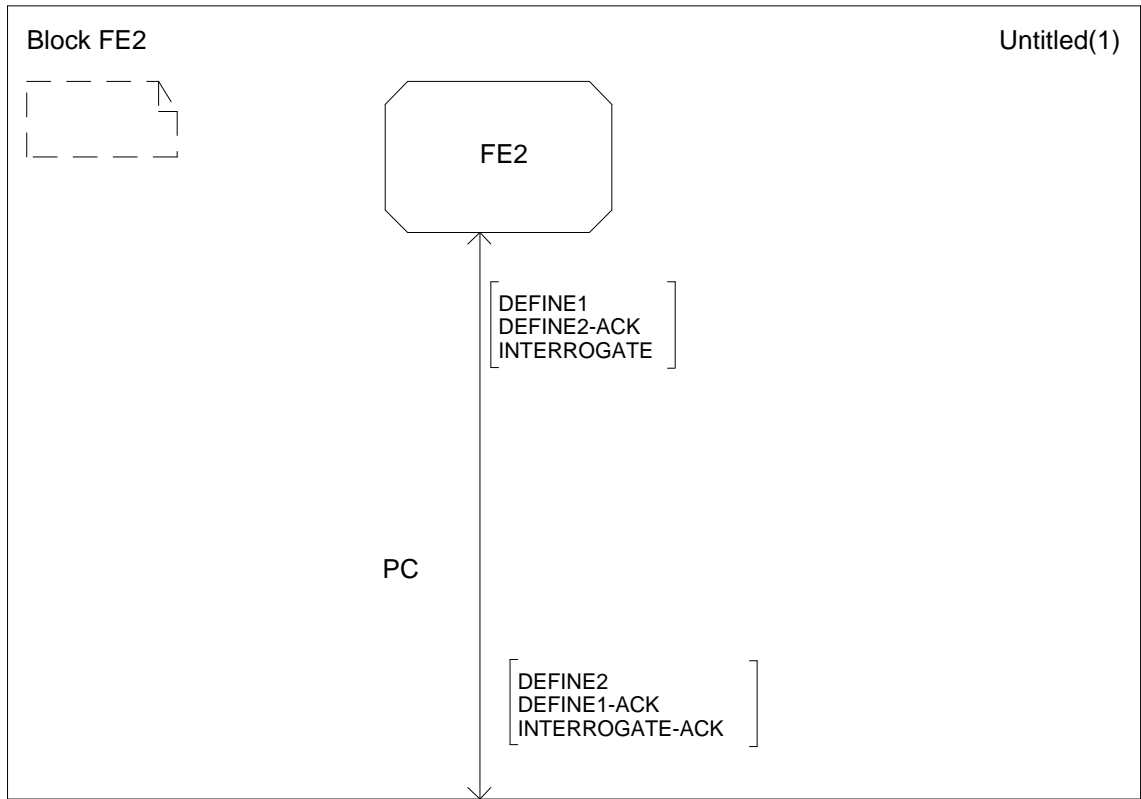
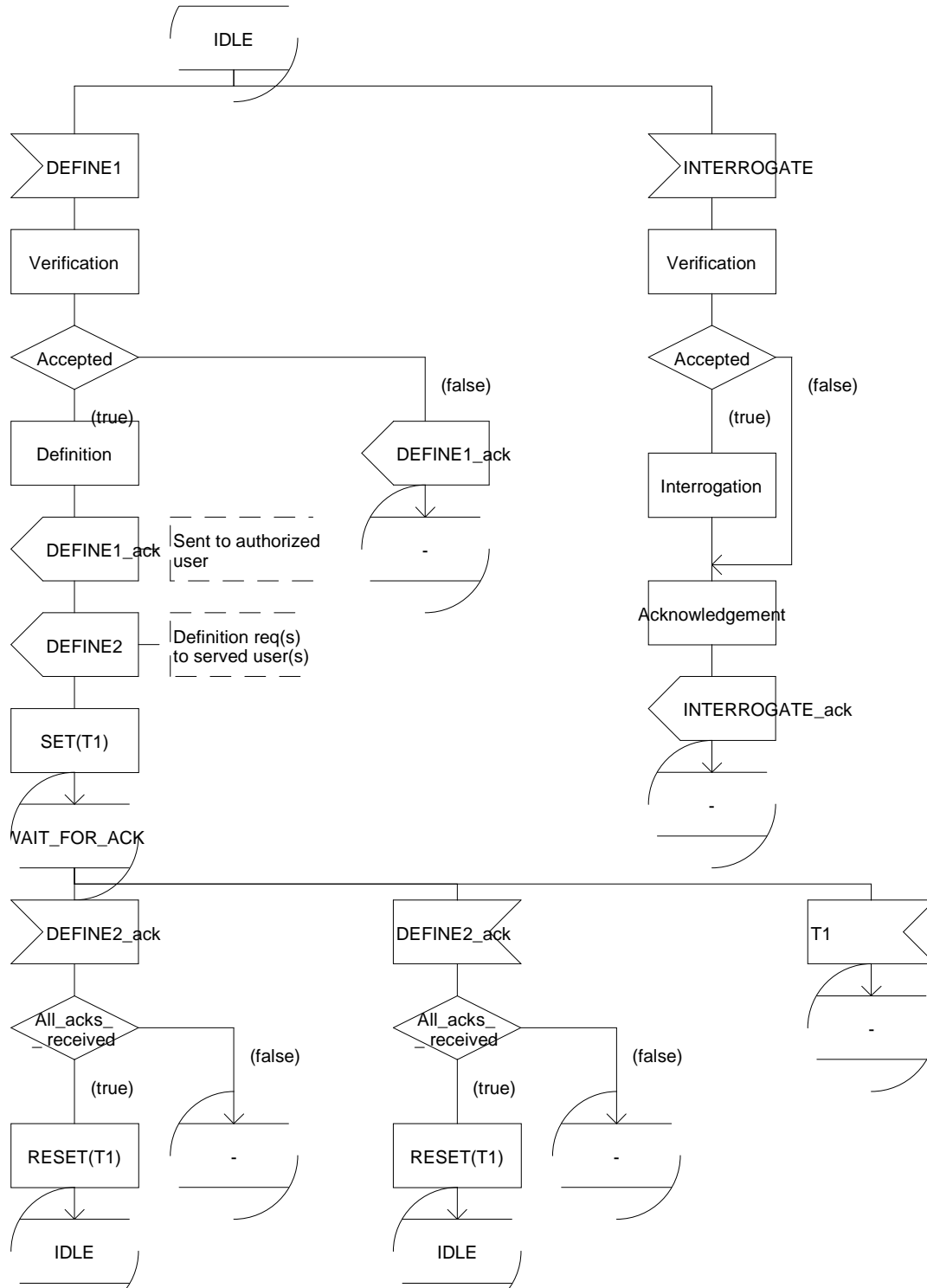


Figure 7: Service interaction for FE2

7.2.2 Process description of FE2 (SS entity in SwMI)

Process description of FE2 (SS entity in SwMI) is shown in figure 8.

NOTE: In figure 8 only the case when FE1(s) and FE3 are in the same system than FE2 is described. If FE1(s) or FE3 are in different system than FE2, the messages to and from them are sent via FE4 and the input and output information flows should be in reversed direction.



NOTE: FE2 may buffer and send later the definition request(s) to served user(s) if they/it cannot be reached. This is not shown in this figure.

Figure 8: Process description of state IDLE and WAIT-FOR-ACK of FE2

7.3 Behaviour of FE3

7.3.1 Service interaction for FE3 (SS entity in authorized user)

Service interaction for FE3 (SS entity in authorized user) is shown in figure 9.

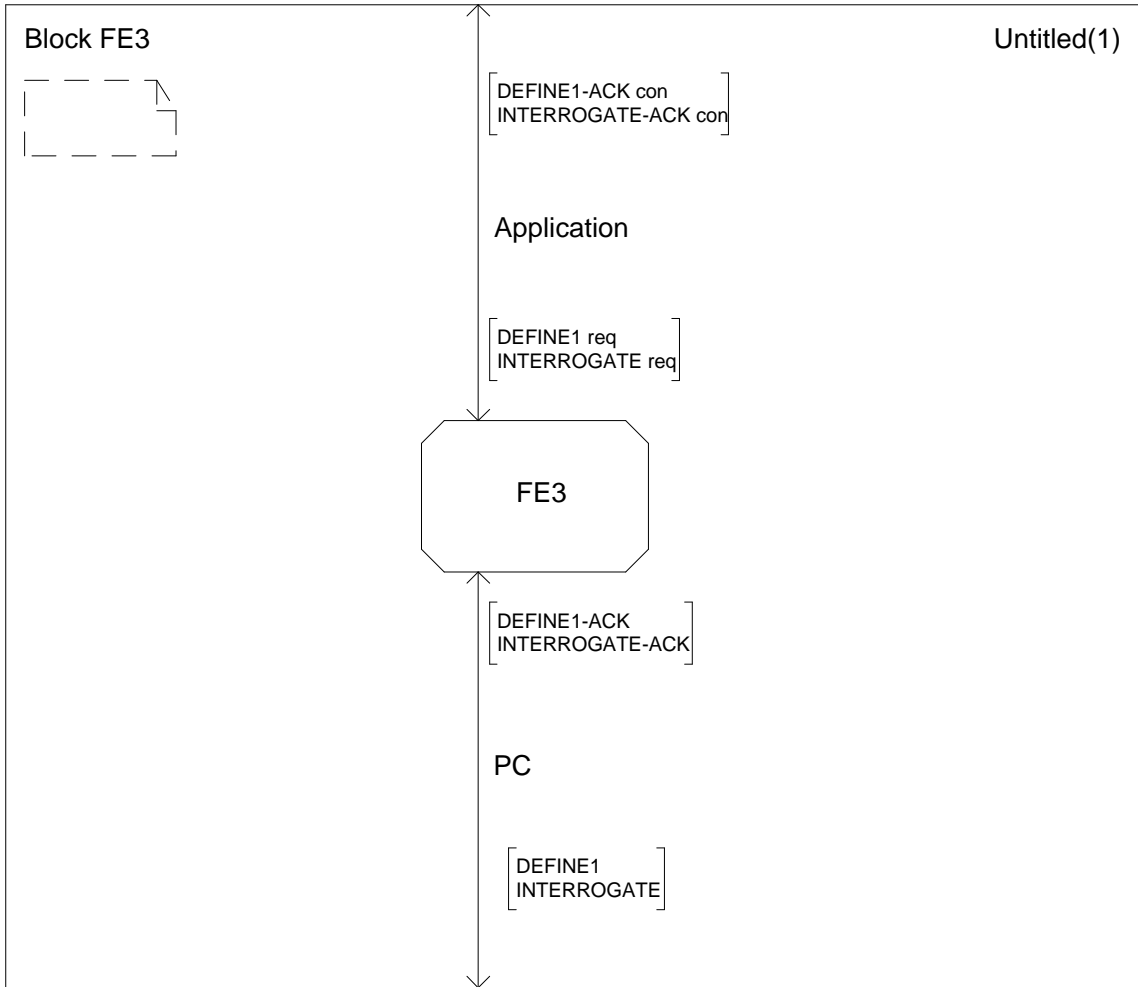
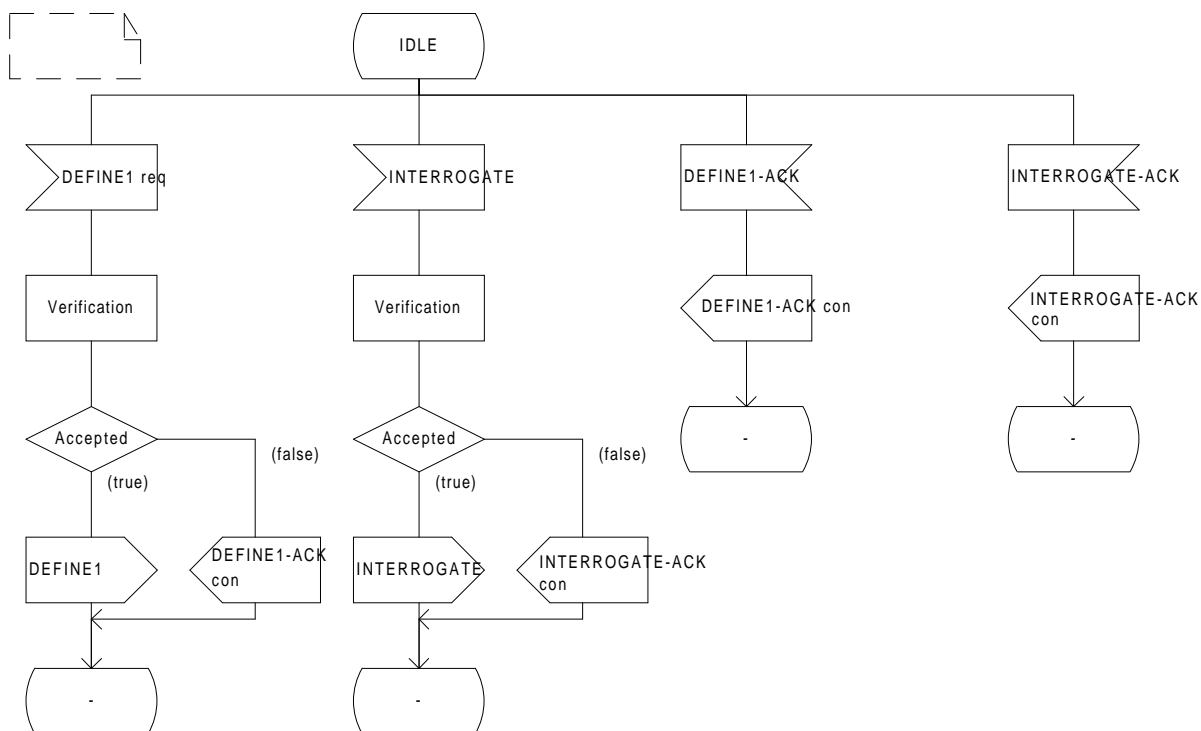


Figure 9: Service interaction for FE3

7.3.2 Process description of FE3 (SS entity in authorized user)

Process description of FE3 (SS entity in authorized user) is shown in figure 10.



NOTE: The definition shall be applied from the moment it is made.

Figure 10: Process description of FE3

7.4 Behaviour of FE4 (informative)

7.4.1 Service interaction for FE4 (SS entity in SwMI in system 2)

Service interaction for FE4 (SS entity in SwMI in system 2) is shown in figure 11.

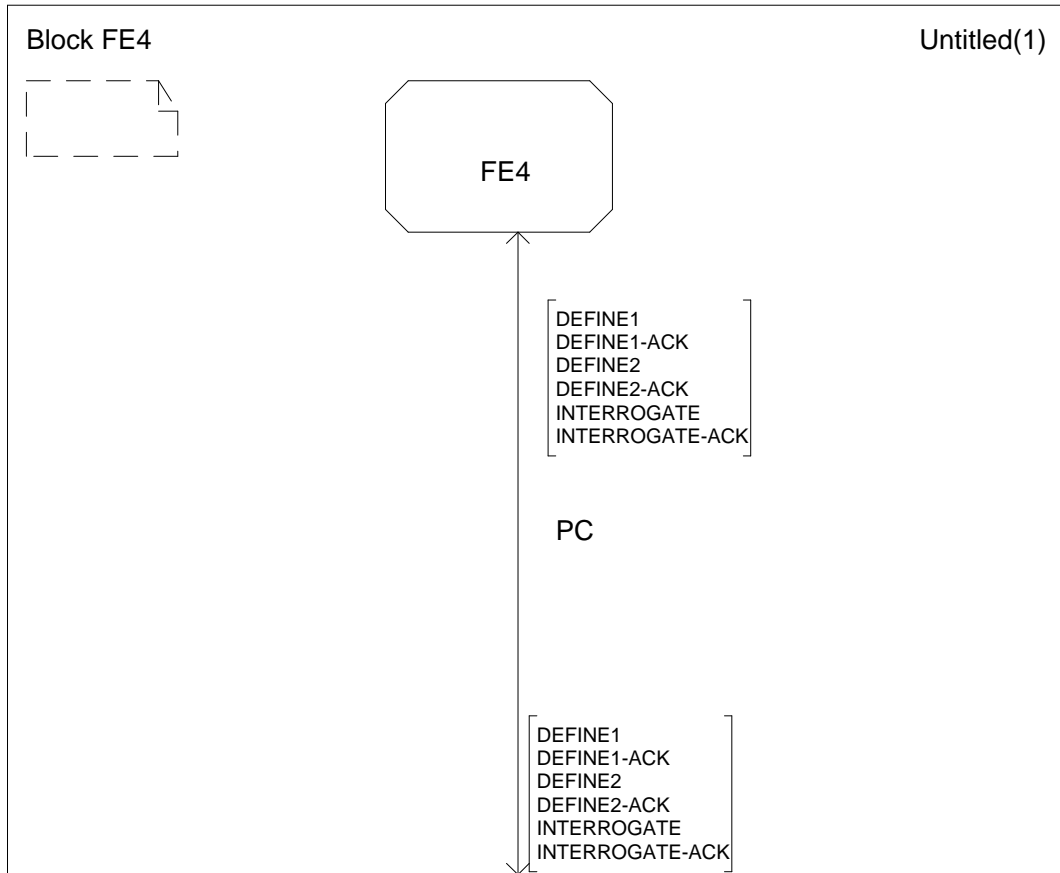


Figure 11: Service interaction for FE4

7.4.2 Process description of FE4 (SS entity in SwMI in system 2)

Process description of FE4 (SS entity in SwMI in system 2) is shown in figure 12.

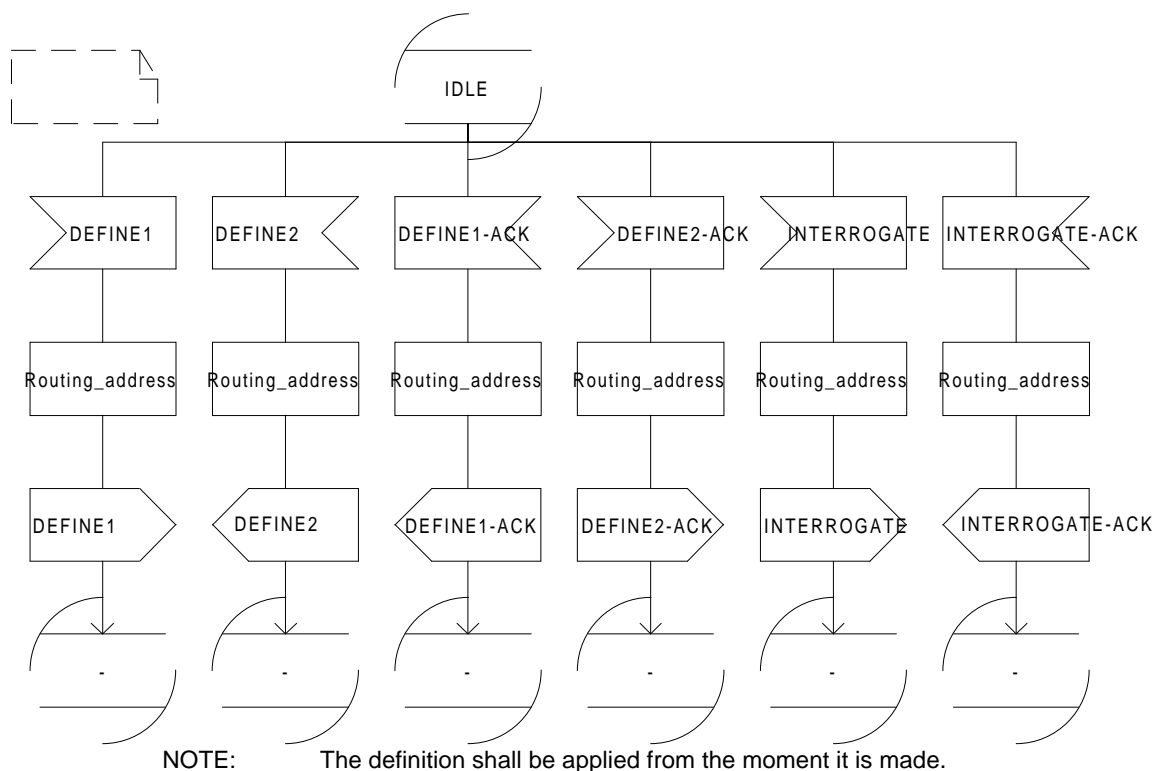


Figure 12: Process description of FE4

7.5 Inter-working considerations

If SS-AP is supported over the ISI, all involved TETRA systems shall be able to send and receive supplementary service information flows over the ISI.

Annex A (informative): Examples of SS-FACILITY elements

A.1 Example of DEFINE1 SS-FACILITY element contents

Table A.1 gives an example of the elements in a SS-AP DEFINE1 facility element that FE3 should construct. It describes a definition made to a subscriber number range where SS-AP is defined for circuit mode speech, SDS (status) and circuit mode data. In the case of circuit mode speech and SDS (status), the APL for low is 3 and the APL for high is 5; in the case of circuit mode data, the APL for low is 2 and the APL for high is 4.

Table A.1: An example of the elements in a SS-AP DEFINE1 FACILITY element

SS-type (~ SS-AP)
Action type (~ Definition)
Argument type (~ Request)
Defined subscriber type (~ range, 2)
1. Defined subscriber number (~ 1st element of the range)
2. Defined subscriber number (~ last element of the range)
Number of basic service definitions (~ 2)
Number of basic services (~ 2)
Basic service(s) (~ circuit mode speech)
Basic service(s) (~ SDS (status))
APL for low priority (~ 3)
APL for high priority (~ 5)
Number of basic services (~1)
Basic service(s) (~ circuit mode data)
APL for low priority (~ 2)
APL for high priority (~ 4)

A.2 Examples of DEFINE1-ACK SS-FACILITY element contents

Example 1 and 2 gives examples of different DEFINE1-ACK SS-FACILITY elements. It is possible that the authorized user has requested the definitions in one DEFINE1 request.

EXAMPLE 1: DEFINE1-ACK for an accepted definition request, see table A.2.

Table A.2: An example of the elements in a SS-AP DEFINE1-ACK FACILITY element, when the definition is accepted for a subscriber number

SS-type (~ SS-AP)
Action type (~ Definition)
Argument type (~ Acknowledgement)
Defined subscriber type (~ subscriber number, 1)
Defined subscriber number (~ the subscriber number)
Result for definition (~ accepted)

EXAMPLE 2: DEFINE1-ACK for a rejected definition request, see table A.3.

Table A.3: An example of the elements in a SS-AP DEFINE1-ACK FACILITY, when the definition is rejected for a subscriber number

SS-type (~ SS-AP)
Action type (~ Definition)
Argument type (~ Acknowledgement)
Defined subscriber type (~ subscriber number, 1)
Defined subscriber number (~ the subscriber number)
Result for definition (~ user not authorized)

A.3 Example of DEFINE2 SS-FACILITY element contents

Table A.4 gives an example of the elements in a SS-AP DEFINE2 FACILITY element that FE2 should send to FE1. It describes a definition made to a subscriber number range where SS-AP is defined for circuit mode speech, SDS (status) and circuit mode data. In case of circuit mode speech and SDS (status), the APL for low is 3 and the APL for high is 5; in case of circuit mode data, the APL for low is 2 and the APL for high is 4.

Table A.4: An example of the elements in a SS-AP DEFINE2 FACILITY element

SS-type (~ SS-AP)
Action type (~ Activation)
Argument type (~ Request)
Defined subscriber type (~ range, 2)
1. Defined subscriber number (~ 1st element of the range)
2. Defined subscriber number (~ last element of the range)
Number of basic service definitions (~ 2)
Number of basic services (~ 2)
Basic service(s) (~ circuit mode speech)
Basic service(s) (~ SDS (status))
APL for low priority (~ 3)
APL for high priority (~ 5)
Number of basic services (~ 1)
Basic service(s) (~ circuit mode data)
APL for low priority (~ 2)
APL for high priority (~ 4)

A.4 Example of INTERROGATE-ACK SS-FACILITY element contents

Table A.5 gives an example of the elements in a SS-AP INTERROGATE-ACK FACILITY element that FE2 should construct. It describes an interrogation response made to a subscriber number where SS-AP is defined for circuit mode speech, SDS (status) and circuit mode data. In case of circuit mode speech and SDS (status), the APL for low is 3 and the APL for high is 5; in case of circuit mode data, the APL for low is 2 and the APL for high is 4.

Table A.5: An example of the elements in a SS-AP INTERROGATE-ACK FACILITY element

SS-type (~ SS-AP)
Action type (~ Interrogation)
Argument type (~ Acknowledgement/Response)
Interrogated subscriber type (~ subscriber number, 1)
Interrogated subscriber number (~ 1st element of the range)
Result for interrogation (~ accepted)
Number of basic service definitions (~ 2)
Number of basic services (~ 2)
Basic service(s) (~ circuit mode speech)
Basic service(s) (~ SDS (status))
APL for low priority (~ 3)
APL for high priority (~ 5)
Number of basic services (~ 1)
Basic service(s) (~ circuit mode data)
APL for low priority (~ 2)
APL for high priority (~ 4)

History

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