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Intelligent Network

**Interface Recommendation for intelligent
network capability set 3: SCF-CUSF interface**

ITU-T Recommendation Q.1238.7

(Formerly CCITT Recommendation)

ITU-T Q-SERIES RECOMMENDATIONS
SWITCHING AND SIGNALLING

| | |
|--|----------------------|
| SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE | Q.1–Q.3 |
| INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING | Q.4–Q.59 |
| FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN | Q.60–Q.99 |
| CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS | Q.100–Q.119 |
| SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4 AND No. 5 | Q.120–Q.249 |
| SPECIFICATIONS OF SIGNALLING SYSTEM No. 6 | Q.250–Q.309 |
| SPECIFICATIONS OF SIGNALLING SYSTEM R1 | Q.310–Q.399 |
| SPECIFICATIONS OF SIGNALLING SYSTEM R2 | Q.400–Q.499 |
| DIGITAL EXCHANGES | Q.500–Q.599 |
| INTERWORKING OF SIGNALLING SYSTEMS | Q.600–Q.699 |
| SPECIFICATIONS OF SIGNALLING SYSTEM No. 7 | Q.700–Q.799 |
| Q3 INTERFACE | Q.800–Q.849 |
| DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1 | Q.850–Q.999 |
| PUBLIC LAND MOBILE NETWORK | Q.1000–Q.1099 |
| INTERWORKING WITH SATELLITE MOBILE SYSTEMS | Q.1100–Q.1199 |
| INTELLIGENT NETWORK | Q.1200–Q.1699 |
| SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000 | Q.1700–Q.1799 |
| BROADBAND ISDN | Q.2000–Q.2999 |

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ITU-T Recommendation Q.1238.7

Interface Recommendation for intelligent network capability set 3: SCF-CUSF interface

Summary

The Q.1238.x series of ITU-T Recommendations defines the Intelligent Network (IN) Application Protocol (INAP) for IN Capability Set 3 (IN CS-3), the INAP for IN CS-3 based upon IN CS-2 Q.1228 and Q.1224 specification (1997) and the general rules for INAP provided in Q.1208, and is consistent with the scope of IN CS-3 as defined in ITU-T Q.1231.

Within the Q.123x series of Recommendations, the Q.1238.x series describes the protocol realizing the Q.1231 Distributed Functional Plane in a service and vendor implementation independent manner, as constrained by the capabilities of the embedded base of network technology. This provides the flexibility to allocate distributed functionality into multiple physical network configurations and to evolve IN from IN CS-3 to some future IN CS-N.

This Recommendation belongs to Q.1238.x series of ITU-T Recommendations for IN Capability Set 3. It covers the CUSF-SCF interface including the description of the aspects of the CUSF and SCF Functional Entities which are relevant to this interface.

This Recommendation includes an electronic attachment containing clause 13 ASN.1 definitions.

Source

ITU-T Recommendation Q.1238.7 was prepared by ITU-T Study Group 11 (1997-2000) and approved under the WTSC Resolution 1 procedure on 15 June 2000.

Keywords

Intelligent Network (IN), Intelligent Network Application Protocol (INAP), IN Capability Set 3 (IN CS-3), Service Control Function (SCF), Call Unrelated Service Function (CUSF).

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The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSC Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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CONTENTS

| | Page |
|--|-------------|
| 1 Scope..... | 1 |
| 2 References..... | 1 |
| 3 Abbreviations and acronyms | 1 |
| 4 Relationships..... | 1 |
| 4.1 SCF-CCF/CUSF relationship | 1 |
| 4.2 CUSF-SSF relationship..... | 1 |
| 5 CCF/CUSF model..... | 1 |
| 5.1 General..... | 1 |
| 5.2 CCF/CUSF components | 2 |
| 5.2.1 Basic Non-Call Manager (BNCM)..... | 2 |
| 5.2.2 IN – Non-Switching Manager (IN-NSM) | 2 |
| 5.2.3 Feature Interaction Manager/Non-Call Manager (FIM/NCM) | 2 |
| 5.3 Relationship of CCF/CUSF model components..... | 2 |
| 5.3.1 BNCM relationship to IN-NSM | 2 |
| 5.3.2 BNCM and IN-NSM relationship to FIM/NCM | 2 |
| 5.4 BCUSM (Basic Call Unrelated State Model)..... | 2 |
| 5.4.1 BCUSM description | 4 |
| 5.4.2 BCUSM DP criteria..... | 8 |
| 6 SCF model | 9 |
| 7 FSM for CUSF | 9 |
| 7.1 Relations between CUSF FSM and the SSF/CCF and maintenance functions | 9 |
| 7.2 CUSF state transition diagram..... | 11 |
| 7.2.1 State a: "Idle" | 12 |
| 7.2.2 State b: "Waiting for Instructions" | 13 |
| 7.2.3 State c: "Monitoring" | 14 |
| 8 FSM for SCF..... | 14 |
| 8.1 Overview..... | 14 |
| 8.2 SCME FSM..... | 15 |
| 8.3 CUSF related states (SCSM-CUSF)..... | 15 |
| 8.3.1 State N1: "Idle" | 16 |
| 8.3.2 State N2: "Preparing CUSF Instructions" | 16 |
| 9 FSM for USI | 19 |
| 9.1 Overview..... | 19 |
| 9.2 SCF USI FSM for CUSF | 21 |

| | Page |
|--|-------------|
| 9.3 CUSF USI FSM | 21 |
| 10 Operation procedures | 21 |
| 10.1 ActivationReceivedAndAuthorized procedure | 22 |
| 10.1.1 General description | 22 |
| 10.1.2 Parameters | 22 |
| 10.1.3 Invoking entity (CUSF) | 23 |
| 10.1.4 Responding entity (SCF) | 23 |
| 10.2 ActivityTest procedure | 24 |
| 10.2.1 General description | 24 |
| 10.2.2 Parameters | 24 |
| 10.2.3 Invoking entity (SCF) | 24 |
| 10.2.4 Responding entity (CUSF) | 24 |
| 10.3 AssociationReleaseRequested procedure | 25 |
| 10.3.1 General description | 25 |
| 10.3.2 Parameters | 25 |
| 10.3.3 Invoking entity (CUSF) | 26 |
| 10.3.4 Responding entity (SCF) | 26 |
| 10.4 ComponentReceived procedure | 26 |
| 10.4.1 General description | 26 |
| 10.4.2 Parameters | 27 |
| 10.4.3 Invoking entity (CUSF) | 27 |
| 10.4.4 Responding entity (SCF) | 27 |
| 10.5 ConnectAssociation procedure | 28 |
| 10.5.1 General description | 28 |
| 10.5.2 Parameters | 28 |
| 10.5.3 Invoking entity (SCF) | 28 |
| 10.5.4 Responding entity (CUSF) | 29 |
| 10.6 ContinueAssociation procedure | 29 |
| 10.6.1 General description | 29 |
| 10.6.2 Parameters | 29 |
| 10.6.3 Invoking entity (SCF) | 29 |
| 10.6.4 Responding entity (CUSF) | 30 |
| 10.7 EventReportBCUSM procedure | 30 |
| 10.7.1 General description | 30 |
| 10.7.2 Parameters | 31 |
| 10.7.3 Invoking entity (CUSF) | 31 |
| 10.7.4 Responding entity (SCF) | 32 |
| 10.8 InitialAssociationDP procedure | 32 |
| 10.8.1 General description | 32 |

| | Page |
|---|-------------|
| 10.8.2 Parameters | 32 |
| 10.8.3 Invoking entity (CUSF)..... | 33 |
| 10.8.4 Responding entity (SCF)..... | 34 |
| 10.9 InitiateAssociation procedure | 34 |
| 10.9.1 General description..... | 34 |
| 10.9.2 Parameters | 34 |
| 10.9.3 Invoking entity (SCF)..... | 34 |
| 10.9.4 Responding entity (CUSF) | 35 |
| 10.10 ReleaseAssociation procedure | 35 |
| 10.10.1 General description..... | 35 |
| 10.10.2 Parameters | 35 |
| 10.10.3 Invoking entity (SCF)..... | 35 |
| 10.10.4 Responding entity (CUSF) | 35 |
| 10.11 ReportUTSI procedure..... | 36 |
| 10.11.1 General description..... | 36 |
| 10.11.2 Parameters | 36 |
| 10.11.3 Invoking entity (CUSF)..... | 36 |
| 10.11.4 Responding entity (SCF)..... | 36 |
| 10.12 RequestReportBCUSMEvent procedure | 37 |
| 10.12.1 General description..... | 37 |
| 10.12.2 Parameters | 37 |
| 10.12.3 Invoking entity (SCF)..... | 38 |
| 10.12.4 Responding entity (CUSF) | 38 |
| 10.13 RequestReportUTSI procedure..... | 38 |
| 10.13.1 General description..... | 38 |
| 10.13.2 Parameters | 38 |
| 10.13.3 Invoking entity (SCF)..... | 39 |
| 10.13.4 Responding entity (CUSF) | 39 |
| 10.14 SendComponent procedure..... | 39 |
| 10.14.1 General description..... | 39 |
| 10.14.2 Parameters | 39 |
| 10.14.3 Invoking entity (SCF)..... | 40 |
| 10.14.4 Responding entity (CUSF) | 40 |
| 10.15 SendSTUI procedure..... | 40 |
| 10.15.1 General description..... | 40 |
| 10.15.2 Parameters | 40 |
| 10.15.3 Invoking entity (SCF)..... | 41 |
| 10.15.4 Responding entity (CUSF) | 41 |
| 11 Parameters..... | 41 |

| | Page |
|--|-------------|
| 11.1 Address | 41 |
| 11.2 BCUSMEvents..... | 41 |
| 11.3 BearerCapability | 42 |
| 11.4 CalledPartyNumber | 42 |
| 11.5 CallingPartyNumber | 42 |
| 11.6 CallingPartySubaddress | 42 |
| 11.7 CallUnrelatedDpSpecificCommonParameters | 43 |
| 11.8 Cause..... | 43 |
| 11.9 Component..... | 44 |
| 11.10 ComponentCorrelationID | 44 |
| 11.11 ComponentType..... | 44 |
| 11.12 ComponentTypes | 44 |
| 11.13 CUApplicationInd..... | 44 |
| 11.14 CUDPCriteria..... | 44 |
| 11.15 EventSpecificInformationBCUSM..... | 44 |
| 11.16 EventTypeBCUSM..... | 45 |
| 11.17 GenericNumbers | 45 |
| 11.18 HighLayerCompatibility..... | 45 |
| 11.19 LegID | 45 |
| 11.20 Message | 46 |
| 11.21 MiscCallInfo | 46 |
| 11.22 MonitorDuration | 46 |
| 11.23 RequestedUTSIList..... | 46 |
| 11.24 ServiceKey..... | 46 |
| 11.25 USIInformation..... | 46 |
| 11.26 USIServiceIndicator..... | 46 |
| 12 Error procedures | 46 |
| 12.1 Operation-related error procedures..... | 47 |
| 12.1.1 MissingCustomerRecord | 47 |
| 12.1.2 MissingParameter | 48 |
| 12.1.3 ParameterOutOfRange..... | 49 |
| 12.1.4 SystemFailure | 49 |
| 12.1.5 TaskRefused | 49 |
| 12.1.6 UnexpectedComponentSequence | 49 |
| 12.1.7 UnexpectedDataValue | 49 |
| 12.1.8 UnexpectedParameter | 49 |
| 12.1.9 UnknownLegID | 49 |

| | Page |
|--|-------------|
| 12.2 Entity related error procedures | 50 |
| 12.2.1 Expiration of T _{CUSF} | 50 |
| 13 ASN.1 definitions (electronic attachment) | 50 |
| 14 Service assumed by TCAP | 50 |
| 14.1 Normal procedures..... | 50 |
| 14.1.1 CUSF-to-SCF messages | 50 |
| 14.1.2 SCF-to-CUSF messages | 51 |
| 14.2 Abnormal procedures..... | 51 |
| 14.2.1 Dialogue handling..... | 51 |
| 14.2.2 Component handling..... | 52 |

ITU-T Recommendation Q.1238.7

Interface Recommendation for intelligent network capability set 3: SCF-CUSF interface¹

1 Scope

This Recommendation belongs to the Q.1238.x series of ITU-T Recommendations for IN Capability Set 3. It specifies the protocol on the CUSF-SCF interface and provides a description of the aspects of the CUSF and SCF Functional Entities which are involved in the realization of this interface.

2 References

All ITU-T Recommendations and other references are identified in ITU-T Q.1238.1.

3 Abbreviations and acronyms

All abbreviations and acronyms used in this text are defined in ITU-T Q.1238.1.

4 Relationships

4.1 SCF-CCF/CUSF relationship

The SCF-CUSF relationship is used for messages between an SCF and a CUSF in the public network. This relationship provides service or service features which need call-unrelated user interaction. This provides, for example, user location registration, user authentication, supplementary service activation or de-activation. Details of service drivers can be found in ITU-T Q.1231.

This relationship is used for three cases, and respective cases are exclusive for the others.

Case 1) For sending/receiving ROSE APDUs to/from a user.

Case 2) For sending/receiving USI information to/from a user.

Case 3) For relaying some informations for call unrelated association establishment from a supplementary service (e.g. CCBS) in CCF (BCUSM).

4.2 CUSF-SSF relationship

It is considered that the CUSF and the SSF may have a relationship, but the relationship is not defined in IN CS-3, and is not mandatory. This relationship may be used to influence the basic call processing in the SSF/CCF (e.g. activation or de-activation of Call Forwarding) via call-unrelated interaction.

5 CCF/CUSF model

5.1 General

The CCF/CUSF model shown in Figure 1 is for a single-ended service logic instance related to a user. The purpose of this model is to provide a framework for the understanding of call unrelated modelling with respect to the CCF/CUSF.

¹ This Recommendation includes an electronic attachment containing clause 13 ASN.1 definitions.

5.2 CCF/CUSF components

The CCF/CUSF model consists of several entities. Each of the entities is briefly described below. It is noted that this shows a conceptual model of CCF/CUSF and is not intended to imply an actual implementation of the CCF/CUSF.

5.2.1 Basic Non-Call Manager (BNCM)

This entity provides an abstraction of an association and proceedings for call unrelated interactions between a user and a network. It detects basic call unrelated events that can lead to the invocation of IN service logic instances or those that should be reported to active IN service logic instances. It also manages resources required to support basic call unrelated control. The BNCM interacts with the FIM/NCM as described in the FIM/NCM description below. The BNCM also manages the BCUSM and the DP processing logic.

5.2.2 IN – Non-Switching Manager (IN-NSM)

This entity interacts with the SCF via SCF Access Manager in the course of providing IN services/features to users. It provides the SCF with an observable view of a CUSF call unrelated processing activities, and provides the SCF with access to CUSF capabilities, such as managing of an association and invoked operations. It also detects non-call processing events that should be reported to active IN service logic instances or can lead to the invocation of IN service logic instances. It manages CUSF resources required to support IN service logic instances, if any.

5.2.3 Feature Interaction Manager/Non-Call Manager (FIM/NCM)

This entity provides mechanisms to prevent invocation of multiple instances of IN and non-IN service logic instances on a single association. The ability of the FIM/NCM to arbitrate IN/non-IN call associated/call unrelated associated services/features and IN call unrelated associated services/features is outside the scope of this capability set. These two types of arbitration need an implicit relationship. The FIM/NCM integrates these interactions mechanisms with the BNCM and IN-NSM to provide the CUSF with a unified view of call unrelated processing internal to the CUSF for an association.

5.3 Relationship of CCF/CUSF model components

5.3.1 BNCM relationship to IN-NSM

This is the relationship that encompasses the interaction between the BNCM and the IN-NSM, through the FIM/NCM. The message related to this interaction is not externally visible and is not for standardization. However, an understanding of this subject is required to identify how basic call unrelated processing and IN call unrelated processing interact.

5.3.2 BNCM and IN-NSM relationship to FIM/NCM

This is the relationship that encompasses the interaction between the BNCM and the FIM/NCM, and the interaction between the IN-NSM and the FIM/NCM. The messages related to these interactions are not externally visible and are not for standardization. However, an understanding of this subject is required in order to unify the BNCM, IN-NSM and FIM/NCM.

5.4 BCUSM (Basic Call Unrelated State Model)

This model relates to the call unrelated associated connection-oriented interaction between the user and the IN service logic using existing ISDN user-to-network signalling procedures.

The main concept of the BCUSM is similar to the BCSM. The BCUSM is a high-level description of the CCF activities required to establish and maintain an association between users and service processing, to manage invoked operations. For this, it identifies a set of basic call unrelated

associated activities in the CCF and shows how these activities are joined together to process a basic call unrelated associated services/features (e.g. establish and maintain an association between a user and a network, manage this and all operation invocations).

Many aspects of the BCUSM are not externally visible to IN service logic instances. However, aspects of the BCUSM that are reflected upward to the IN-NSM and FIM/NCM are visible to IN service logic instance. Only these aspects of the BCUSM will be the subjects of standardization. Therefore, the BCUSM is primarily an explanatory tool for providing a representation of CCF activities that can be analysed to determine which aspects of the BCUSM will be visible to IN service logic instances, if any, and what level of abstraction and granularity is appropriate for this visibility.

The BCUSM identifies points when IN service logic instances are permitted to interact with basic call unrelated interaction processing (for the time being it is reasonable to assume ROSE procedures). In particular, it provides a framework for describing basic call unrelated events that can lead to the invocation of IN service logic instances or reporting of the events to the active logic, for describing those points in association and operation processing when the transfer of control can occur.

Figure 2 shows the components that have been identified to describe a BCUSM. Points in association (PIA), detection points (DPs). Transitions and events are not depicted in the figure, but they are self-explanatory. Figure 2 also shows the BCUSM. PIAs represent the states of an association for the call unrelated interaction. The concepts of DPs are same as the BCSM, however an IN service logic instance can influence a call unrelated interaction processing with specifying a ROSE APDU (invoke, return result, return error, reject) which should be delivered via appropriate signalling messages between the user and the network (e.g. REGISTER, FACILITY, REL, and REL COMP on DSS1).

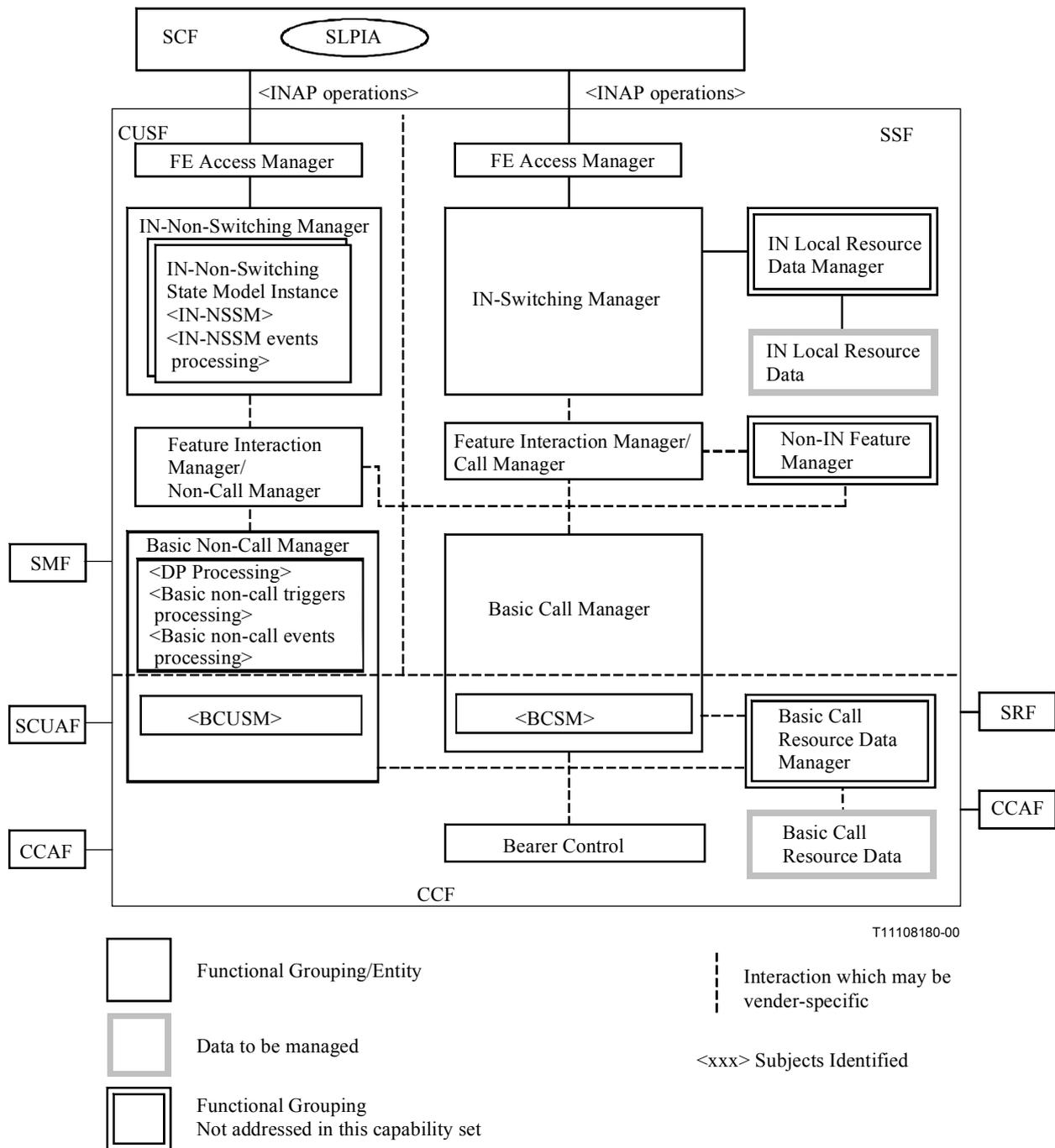


Figure 1/Q.1238.7 – Internal CUSF structure and the relationship between FEs

5.4.1 BCUSM description

In the following descriptions, the PIAs are related at a high level to the procedure taking place in an entity that supports ROSE. To help the understandings, Q.931 and Q.932 messages with information elements are attached to the description, however these do not intend to limit the scope of BCUSM only to DSS1.

The following is the BCUSM description for this capability set.

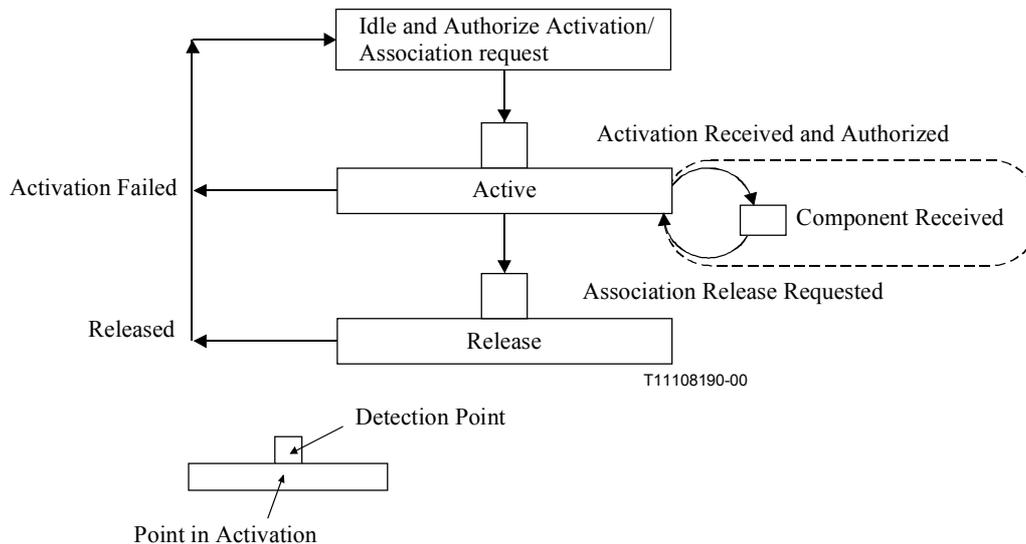


Figure 2/Q.1238.7 – BCUSM

5.4.1.1 BCUSM model for ROSE APDU

5.4.1.1.1 Idle and Authorize Activation/Association request

Entry Event:

- All previously invoked operations between a user and a network are completed (event: Released), or the (last) invocation of an operation was rejected by the user or the network (event: Activation Failed). There is no relationship between the user and the network; e.g. no call reference exists between the user and the network.

Functions:

- Logical association is idled (e.g. no call reference, no data link connection).
- When the indication to establish an association and optionally invoke an operation is received (e.g. Q.932 REGISTER with FACILITY IE), the authority/ability of the user invoking the particular operation is verified. For example, some restrictions may be checked that are assigned to the used access, such as invoking User Registration is prohibited, if any.

Exit Event:

- An indication to establish an association and optionally invoke an operation is received (e.g. Q.932 REGISTER with FACILITY IE), the authority/ability of the user invoking the particular operation was verified (DP Activation Received and Authorized).

5.4.1.1.2 Active

Entry Event:

- An indication to establish an association and optionally invoke an operation is received (e.g. Q.932 REGISTER with FACILITY IE), the authority/ability of the user invoking particular operation was verified (DP Activation Received and Authorized), or a response/invocation from the user is received (DP Component Received).

Functions:

- Logical association is established (i.e. a call reference is assigned).
- The received operation is processed and an appropriate response is sent to the user, or the response/invocation from the user is monitored.

Exit Event:

- A response/invocation from the user is received (DP Component Received).
- Activation is failed (Activation Failed).
- An association release request is received from the user or the network (e.g. Q.931 REL). (DP Association Release Requested).

5.4.1.1.3 Release

Entry Event:

- An association release request is received from the user or the network (e.g. Q.931 REL). This request optionally contains response/invocation to the user or from the network (DP Association Release Requested).

Functions:

- The association is being released with appropriate procedures (a pending response may be delivered with an association release message, e.g. Q.931 RELComp). This procedure may deliver final invocation/response to the user or to the network.

Exit Event:

- The association is completely released (Released).

5.4.1.1.4 Transition for BCUSM

Table 1/Q.1238.7 – Transition for BCUSM

| From | To |
|---|---|
| Activation Received and Authorized | Idle and Authorize Activation/Association request |
| Activation Received and Authorized | Active |
| Component Received | Idle and Authorize Activation/Association request |
| Component Received | Active |
| Association Release Requested | Idle and Authorize Activation/Association request |
| NOTE – These transitions are depicted here as they are beyond the normal BCUSM transitions. | |

5.4.1.1.5 Modelling for ROSE APDU handling

The current BCUSM models only the association handling parts and detection of the ROSE APDU as it is received. While it may be possible to model the analysis of the received ROSE APDU and invoke ID, it is not done since all ROSE ADPU are specific to a service. This would mean having to model every service. Therefore, only the general parts (component handling and association handling) are modelled.

The modelling is similar to the BCSM in the sense of how far the interaction portion of the state model depicts the details of the activities in the physical entity, however the interaction is different from the circuit mode switched bearer services (represented by the BCSM) with the following:

- a) the variation of the service triggering points (corresponds to TDP) is limited to the association establishment/release phases or the reception of the ROSE APDU;
- b) the ROSE APDU is received during the association establishment/release phase or within the established association;
- c) the modelling of the analysis of a received ROSE APDU may be not necessary, because it can be well modelled as the TDP criteria check;

- d) the procedures with the interaction vary from service to service and have many variations, so each supplementary service has different states to handle the ROSE APDUs (but, reject or failure of the invocation may be possible to be modelled).

The DP indicates the place of:

- a) the event of the association establishment request or release;
 b) the detection of the ROSE APDU reception (Figure 3 shows what part is service dependent and what part is general for this type of interaction).

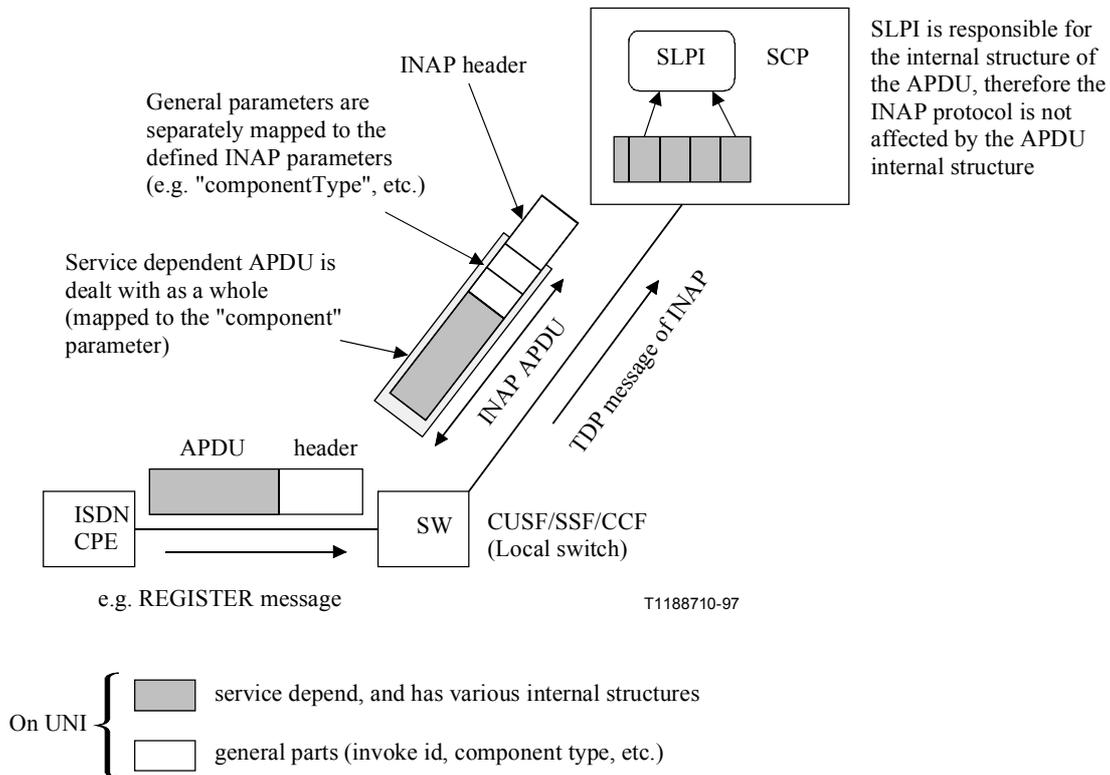


Figure 3/Q.1238.7 – ROSE APDU treatment scheme

5.4.1.2 BCUSM model for association establishment from a service ASE in CUSF

5.4.1.2.1 Idle and Authorize Activation/Association request

Entry Event:

- A previously invoked call unrelated association establishment is completed (event: Released), or the (last) association establishment was failed (event: Activation Failed). There is no association for a service ASE in CUSF.

Functions:

- Logical association is idled.
- When the request to establish a call unrelated association from a service ASE in CUSF is received, the authority/ability of the invocation of the association establishment is verified.

Exit Event:

- The authority/ability of invoking the association establishment was verified (DP Activation Received and Authorized).

5.4.1.2.2 Active

Entry Event:

- The authority/ability of invoking the association establishment was verified (DP Activation Received and Authorized); or
- a response for the call unrelated association is received (DP Component Received).

Functions:

- Logical association is established.
- The response is processed and a further response is monitored.

Exit Event:

- A response for the call unrelated association establishment is received (DP: Component Received).
- The association establishment is failed (Activation Failed).
- The association is released (DP: Association Release Requested).

5.4.1.2.3 Release

Entry Event:

- The association is released (DP: Association Release Requested).

Functions:

- The association is being released with appropriate procedures.

Exit Event:

- The association is completely released (Released).

5.4.1.2.4 Transition for BCUSM

Table 2/Q.1238.7 – Transition for BCUSM

| From | To |
|------------------------------------|---|
| Activation Received and Authorized | Idle and Authorize Activation/Association request |
| Activation Received and Authorized | Active |
| Component Received | Idle and Authorize Activation/Association request |
| Component Received | Active |
| Association Release Requested | Idle and Authorize Activation/Association request |
| Association Release Requested | Active |

NOTE – These transitions are depicted here as they are beyond the normal BCUSM transitions.

5.4.2 BCUSM DP criteria

As for CS-3 BCUSM, the DP criteria means to check the specific out-channel interaction activation at the Activation Received and Authorized, or Component Received DP against the specified pattern, for example an operation code for ROSE like interaction. The formal description is not defined for IN CS-3.

Following table denotes the applicability of DP criteria to DPs of BCUSM. The entries in the table can be (these are the same as the BCSM):

- Line-Based (Subscriber line or Trunk line);
- Group-Based (including Private Facility Group);
- Office-Based.

Table 3/Q.1238.7 – BCUSM DP criteria

| DP criteria | DPs | |
|---|---------------------------------|-------------------|
| | ActivationReceivedAndAuthorized | ComponentReceived |
| Trigger Assigned | X | X |
| ITU-T ISDN supplementary services' operation codes | X | O |
| Regional/Network operator specific ISDN supplementary services' operation codes (Note) | X | O |
| USIServiceIndicator | X | O |
| NOTE – The total number of the codes is regional or network operator specific. X Applicable O Optional (The meaning of "X" and "O" is the same as for the BCSM.) | | |

6 SCF model

Refer to ITU-T Q.1238.1.

7 FSM for CUSF

7.1 Relations between CUSF FSM and the SSF/CCF and maintenance functions

The primitive interface between the CUSF FSM and the CCF/SSF/maintenance functions is an internal interface and is not subject to standardization in IN CS-3. Nevertheless, this interface should be in line with the BCUSM defined in 5.4.

The relationship between the BCUSM and the CUSF FSM may be described as follows for the case of a call unrelated association/operation attempt from an end user or IN service logic:

- When a call unrelated associated association/operation attempt is initiated by an end user and processed at an exchange, an instance of a BCUSM is created. As the BCUSM proceeds, it encounters detection points (DPs, see 5.4). If a DP is armed as a Trigger DP (TDP), an instance of a CUSF FSM is created.
- If an InitiateAssociation is received from the SCF, an instance of a BCUSM is created, as well as an instance of a CUSF FSM.

The CUSF logic should:

- perform the DP processing actions, including if DP criteria are met;
- check for SCF accessibility; and
- handle service feature interactions in conjunction with the SSF.

NOTE – This processing is optional and network specific, and there are no more descriptions for these interactions.

The CUSF hands control back to the CCF at least in the following cases:

- if a trigger (TDP) criteria match is not found (e.g. insufficient information to proceed): the CUSF logic returns supplementary service control processing to the CCF;
- if the association is abandoned: the CUSF logic returns supplementary service control processing to the CCF;
- if the destination SCF is not accessible: the CUSF logic will apply final treatment to the end user for the TDP-R case, or return supplementary service control processing to the CCF for the TDP-N case.

The management functions related to the execution of operations received from the SCF are executed by the CUSF Management Entity (CUSME)-control. The CUSME-control interfaces the different CUSF FSMs and the Functional Entity Access Manager (FEAM). Figure 4 shows the CUSF Interfaces.

The function of FEAM is defined in ITU-T Q.1238.1.

The CUSME-control maintains the dialogues with the SCF on behalf of all instances of the CUSF Finite State Model (FSM). These instances of the CUSF FSM occur concurrently and asynchronously as associations occur, which explains the need for a single entity that performs the task of creation, invocation, and maintenance of the CUSF FSMs. In particular the CUSME-control performs the following tasks:

- 1) interprets the input messages from other FEs and translates them into corresponding CUSF FSM events;
- 2) translates the CUSF FSM outputs into corresponding messages to other FEs;
- 3) captures asynchronous (with processing association and/or operation request from the end user) activities related to management or supervisory functions in the CUSF;
- 4) checks the existence of a CUSF-SCF relationship by receiving an ActivityTest operation from the SCF and returns the result to the SCF.

The CUSF FSM passes component-handling instructions to the related instances of the BCUSM as needed. DPs may be dynamically armed as EDPs, requiring the CUSF FSM to remain active. At some point, further interaction with the SCF is not needed, and the CUSF FSM may be terminated while the BCUSM continues to handle the association as needed.

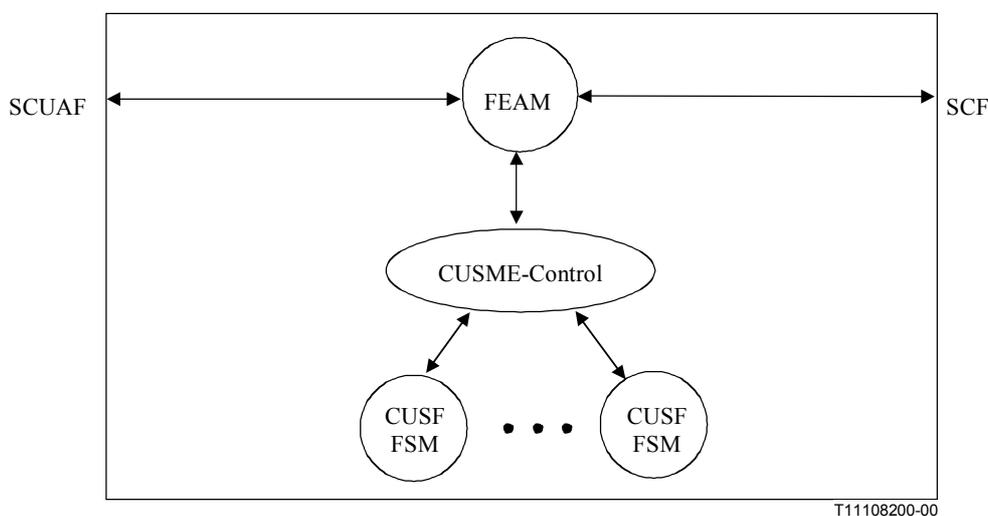


Figure 4/Q.1238.7 – CUSF interfaces

7.2 CUSF state transition diagram

Figure 5 shows the state diagram of the CUSF part of the SSP, CUSP, SN (see ITU-T Q.1205) during the processing of an IN association request from the user or IN service logic/operation attempt.

Each state is discussed in the following sections. General rules applicable to more than one state are addressed here.

One or a sequence of components received in one or more TCAP messages may include a single operation or multiple operations, and is processed as follows:

- Process the operations in the order in which they are received.
- Each operation causes a state transition independent of whether a single operation or multiple operations are received in a message.
- The CUSF examines subsequent operations in the sequence. As long as sequential execution of these operations would leave the FSM in the same state, it will execute them. If a subsequent operation causes a transition out of the state then the following operations should be buffered until the current operation has been executed. In all other cases, await an event that would cause a transition out of the current state (such an event would be the completion of operation being executed, or reception of an external event). An example of this is as follows:

The CUSF receives the operations **SendComponent**, **ReleaseAssociation** in a component sequence inside a single TCAP message. Upon receipt of this message, these operations are executed up to and including **SendComponent** while the CUSF is in the Waiting for Instructions state. However, if the **SendComponent** specifies to deliver the component with an association release message to the user, the actual transmission of the component should be deferred until the next operation, **ReleaseAssociation**. The operation will be executed when the FSM transits to the Idle state.

- If there is an error in processing one of the operations in the sequence, the CUSF FSM processes the error (see below) and discards all remaining operations in the sequence.
- If an operation is not understood or is out of context (i.e. violates the SACF rules defined by the CUSF FSM) as described above, the CUSF aborts the TC dialogue.

In any state, if there is an error in a received operation, the maintenance functions are informed and the CUSF FSM remains in the same state as when it received the erroneous operation. Depending on the class of the operation, the error could be reported by the CUSF to the SCF using the appropriate component (ITU-T Q.774).

In any state (except Idle), if the user requesting the association abandons before it is established (i.e. before the Active PIA in the BCUSM), then the CUSF should clear the association and ensure that any CUSF and CCF resources allocated to the association have been de-allocated. Then the CUSF FSM moves to the Idle state.

In any state (except Idle), if the user releases a stable association (i.e. from the Active PIA in the BCUSM), then the CUSF FSM should move to the Idle state.

The CUSF has an application timer, T_{CUSF} , whose purpose is to prevent excessive association processing suspension time and to guard the association between the CUSF and the SCF.

Timer T_{CUSF} is set in the following cases:

- when the CUSF sends a TDP-R/EDP-R reporting operation (refer to 7.2 State b: Waiting for Instructions);
- when the CUSF receives an InitiateAssociation operation from the SCF;

- when the CUSF FSM enters the Waiting for Instructions state under any other conditions than the ones listed above. If the timer is already active, the timer is restarted.

On expiration of T_{CUSF} the CUSF FSM transits to the Idle state and aborts the TC dialogue with the SCF, and the CUSF proceeds with the BCUSM if possible.

The CUSF state diagram contains the following transitions (events):

- er1 TDP-R encountered.
- er2 Idle return from Waiting for Instructions.
- er3 Request to send a component received (if no EDP armed) or monitoring instruction received.
- er4 TDP-N encountered.
- er5 Request to send a component received (if EDP(s) armed).
- er6 EDP-N not last encountered.
- er7 EDP-N last encountered or monitor duration for last EDP expired.
- er8 EDP-R encountered.
- er10 Initiate association received.

The CUSF state diagram contains the following states:

- State a Idle.
- State b Waiting for Instructions.
- State c Monitoring.

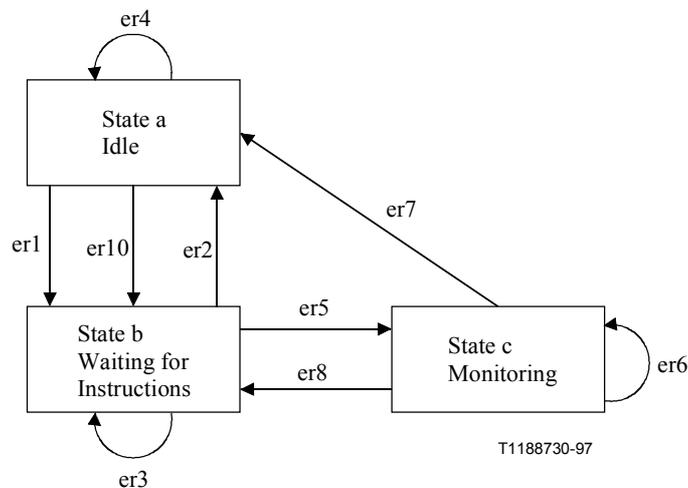


Figure 5/Q.1238.7 – CUSF FSM

7.2.1 State a: "Idle"

The CUSF FSM enters the Idle state when sending or receiving an ABORT TCAP primitive due to abnormal conditions in any state.

The CUSF FSM enters the Idle state when one of the following occurs:

- when the association is released by the end user request in the Waiting for Instructions (transition er2) or in the Monitoring (transition er7);
- when a **ReleaseAssociation**, a **ConnectAssociation** or a **ContinueAssociation (without monitor requested)** operation is processed in the Waiting for Instructions (transition er2);

- when a last EDP-N is reported in the Monitoring (transition er7);
- when the application timer T_{CUSF} expires in the Waiting for Instructions state (transition er2).

When transiting to the Idle state, if there is a component to be delivered with an association release message to the user, the CUSF sends the component with the specified association release message to the SCUAF before returning to Idle.

During this state, the following call unrelated associated event can occur:

- an armed TDP is encountered related to a possible IN call unrelated attempt, the CUSF FSM acts as described below:
 - if the DP is a TDP-N, send a **DP-specific operation** or an **InitialAssociationDP** to the SCF, as determined from DP processing; there is no resulting transition to a different state (transition er4);
 - if the DP is a TDP-R, send a **DP-specific operation** or an **InitialAssociationDP** to the SCF, as determined from DP processing, and transit to the Waiting for Instructions state (transition er1);
- a message related to a new transaction containing an **InitiateAssociation** operation is received from the SCF: in this case the CUSF sends a return result for the operation and moves to the state Waiting for Instructions (transition er10).

Any other operation received from the SCF while the CUSF is in Idle state should be treated as an error. The event should be reported to the maintenance functions and the transaction should be aborted according to the procedure specified in TCAP (ITU-T Q.774).

NOTE – *DP specific* operations are the following: ActivationReceivedAndAuthorized, ComponentReceived and AssociationReleaseRequested.

7.2.2 State b: "Waiting for Instructions"

This state is entered from the Idle state on sending an **InitialAssociationDP** or a **DP Specific operation** (transition er1) or on receiving an **InitiateAssociation** (transition er10), or from the Monitoring state on detection of an EDP-R (transition er8).

In this state the CUSF FSM is waiting for an instruction from the SCF; association handling/supplementary service processing is suspended and an application timer (T_{CUSF}) should be set on entering this state.

During this state the following events can occur:

- The user releases the association. This should be processed in accordance with the general rules in 7.2.
- The application timer T_{CUSF} expires: the CUSF FSM moves to the Idle state, the CUSF processes the invocation if possible, the T_{CUSF} expiration is reported to the maintenance functions and the transaction is aborted.
- An operation is received from the SCF: The CUSF FSM acts according to the operation received as described below.

The following operations may be received from the SCF and processed by the CUSF with no resulting transition to a different state (transition er3):

SendComponent (if no EDP is armed),

RequestReportBCUSMEvent.

The following operations may be received from the SCF and processed by the CUSF, causing a state transition to the Monitoring state (transition er5):

SendComponent (if EDP(s) is(are) armed),

ConnectAssociation (if EDP(s) is(are) armed),

ContinueAssociation (if EDP(s) is(are) armed).

ReleaseAssociation operation may be received from the SCF. In this case, the CUSF FSM transits to the Idle state (transition er2). In addition, the CUSF should release the association to the user and ensure that any CUSF resources allocated to the association have been de-allocated.

ContinueAssociation or **ConnectAssociation** operation may be received from the SCF. In this case, the CUSF FSM transits to the Idle state (transition er2). In addition, the CUSF returns the service control to the suspended association handling/supplementary service processing in the CUSF if no DP is armed.

Any other operations received in this state should be processed in accordance with the general rules in 7.2.

7.2.3 State c: "Monitoring"

The CUSF enters this state from the Waiting for Instructions state (transition er5) upon receiving a **SendComponent**, **ContinueAssociation** or **ConnectAssociation** if EDP(s) is (are) armed.

In this state, the timer T_{CUSF} is not used.

During this state the following events can occur:

- An EDP-N should be reported to the SCF by sending a **DP specific operation** or an **EventReportBCUSM operation**; the CUSF FSM should remain in the Monitoring state (transition er6) if one or more EDPs are armed. The CUSF FSM should move to the Idle state (transition er7) if there are no remaining EDPs armed.
- An EDP-R should be reported to the SCF by sending a **DP specific operation** or an **EventReportBCUSM operation**; the CUSF FSM should move to the Waiting for Instructions state (transition er8).
- The receipt of an END or ABORT primitive from TCAP handling the INAP has no effect on the association; the association may continue or be completed with the information available. In this case, the CUSF FSM transits to the Idle state (transition er7), disassociating the CUSF FSM from the association.
- The user abandons or releases the association. This should be processed in accordance with the general rules in 7.2.

8 FSM for SCF

8.1 Overview

Figure 6 is an SCF FSM structure. Related parts with this clause are:

- SCME FSM interacting with CUSME-control in CUSF; and
- SCSM-CUSF interacting with CUSF FSM in CUSF,

and are highlighted in the figure.

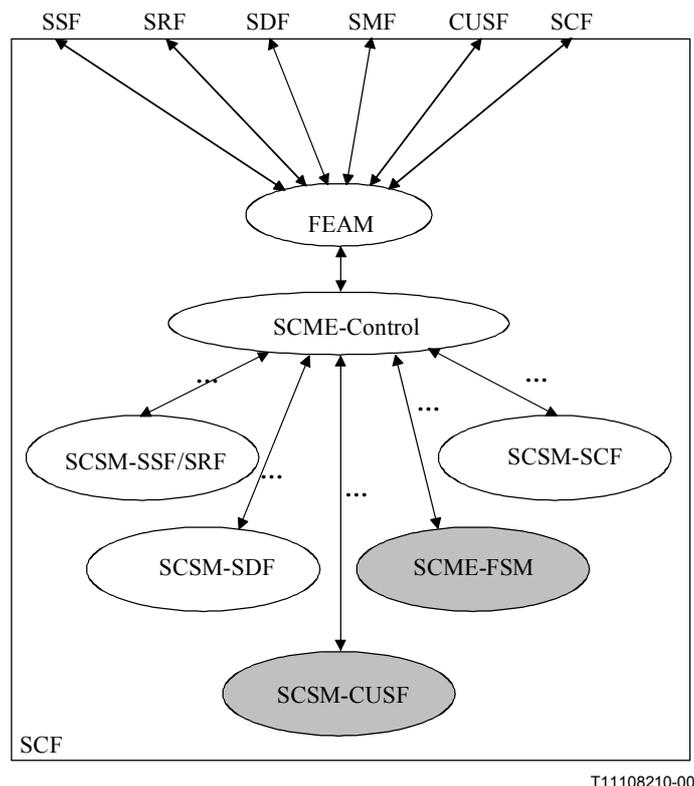


Figure 6/Q.1238.7 – SCF FSM structure

8.2 SCME FSM

The SCME handles an ActivityTest operation in a CUSF-SCF relationship.

The ActivityTest related SCME FSM is the same FSM as defined in ITU-T Q.1238.2 by replacing "SSF" with "CUSF".

8.3 CUSF related states (SCSM-CUSF)

Figure 7 shows State Diagram of the SCSM as relevant to the procedures concerning the FSM for CUSF part of the SCP/AD/SN (see ITU-T Q.1205) during the processing of an IN call. Each state is discussed in one of the following subclauses.

An instance of FSM for CUSF is created on reception of an instruction from the CUSF indicating a TDP and an instruction from the SCF. The instance is released when the state of the instance of FSM for CUSF transits to the state "Idle".

The following operation is a class 1 and requires reception of a Return Result. Reception of the Return Result for the operation does not result in a state transition in the SCSM-CUSF. Furthermore, this Return Result may be received in any state of the SCSM-CUSF.

– InitiateAssociation.

The letter "N" is added to the head of the number of each state and event in FSM for CUSF to distinguish the states and events in FSM for CUSF from those in other FSMs in the SCSM.

Note that "Ne" is an event from SCF (internal event), and "NE" is an event from CUSF (external event).

8.3.1 State N1: "Idle"

The following events are considered in this state:

- (Ne1) CUSF_Initiate_Control_Requested: This is an internal event caused by the service logic's need to have a new control relationship with CUSF. The FSM for CUSF requests to transmit the **InitiateAssociation** operation to the CUSF. This event causes a transition to the state N2, **Preparing CUSF Instructions**.
- (NE2) Query_from_CUSF: This is an external event, caused by a reception of one of the following operations:
 - **ActivationReceivedAndAuthorized (for TDP-R)**,
 - **ComponentReceived (for TDP-R)**,
 - **AssociationReleaseRequested (for TDP-R)**,
 - **InitialAssociationDP (for TDP-R)**.

This event causes a transition to State N2, **Preparing CUSF Instructions**.

- (NE3) Notification_from_CUSF: This is an external event, caused by a reception of one of the following operations:
 - **ActivationReceivedAndAuthorized (for TDP-N)**,
 - **ComponentReceived(for TDP-N)**,
 - **AssociationReleaseRequested (for TDP-N)**,
 - **InitialAssociationDP (for TDP-N)**.

This event causes a transition back to the same state.

8.3.2 State N2: "Preparing CUSF Instructions"

In this state, the SCF prepares appropriate instructions to the CUSF.

The following events are considered in this state:

- (Ne4) Processing_completed: This is an internal event. In this case, the SCF has completed the processing of the instructions to the CUSF. This event causes the following operation to be sent to the CUSF and a transition to State N1, Idle:
 - **ReleaseAssociation**,
 - **ConnectAssociation (no DP armed)**,
 - **ContinueAssociation (no DP armed)**.

To further describe the procedures relevant to this state, the state is divided into two sub-states, which are described in the following two subclauses (this subdivision is illustrated in Figure 8).

8.3.2.1 State N2.1: "Preparing CUSF Instructions"

In this state, the SCF determines whether the BCUSM processing will be resumed and deals with an EDP related processing.

The following events are considered in this state:

- (Ne2.1) Event_Request: this is an internal event caused by the service logic when there is a need to send one or more **RequestReportBCUSMEvent** operations to be issued to the CUSF. This event causes a transition back to state N2.1 Preparing CUSF Instructions.
- (Ne2.2) Request_Send_Component (monitor not required): this is an internal event caused by the service logic when there is no armed EDP but a need to send one or more **SendComponent** operations to be issued to the CUSF. This event causes a transition back to state N2.1 Preparing CUSF Instructions.

- (Ne2.3) Request_Send_Component (monitor required): this is an internal event caused by the service logic when there is (are) an armed EDP(s) and a need to send a **SendComponent** operation to the CUSF. This resumes the call unrelated processing in the CUSF. This event causes a transition to state N2.2 Waiting for Notification or Request.
- (Ne2.8) Request_Processing_Resume (monitor required): this is an internal event caused by the service logic when there is one or more armed EDPs and a need to send a **ContinueAssociation** or a **ConnectAssociation** operation to the CUSF. This also resumes the call unrelated processing in the CUSF. This event causes a transition to state N2.2 Waiting for Notification or Request.
- (Ne2.4) Request_Release_Association: this is an internal event caused by the service logic when it needs to release the association between the user and the network by sending a **ReleaseAssociation** operation to the CUSF. This event maps into the FSM for CUSF in the SCSM event (Ne4).

8.3.2.2 State N2.2: "Waiting for Notification or Request"

In this state, FSM for CUSF waits for a notification or a request from the CUSF.

The following events are considered in this state:

- (NE2.5) EDP-R: this is an external event caused by the reception of one of the following operations:
 - **ComponentReceived (for EDP-R),**
 - **AssociationReleaseRequested (for EDP-R),** and
 - **EventReportBCUSM (for EDP-R).**

This event causes a transition to state N2.1 Preparing CUSF Instructions.

- (NE2.6) Not_Last_EDP-N: this is an external event caused by the reception of one of the following operations:
 - **ComponentReceived (for EDP-N),**
 - **AssociationReleaseRequested (for EDP-N),** and
 - **EventReportBCUSM (for EDP-N).**

In this case, there is still an outstanding armed EDP. This event causes a transition back to State N2.2 Waiting for Notification or Request.

- (NE2.7) Last_EDP-N: this is an external event caused by the reception of one of the following operations:
 - **ComponentReceived (for EDP-N),**
 - **AssociationReleaseRequested (for EDP-N),** and
 - **EventReportBCUSM (for EDP-N).**

This event maps into the FSM for CUSF in the SCSM event (Ne4).

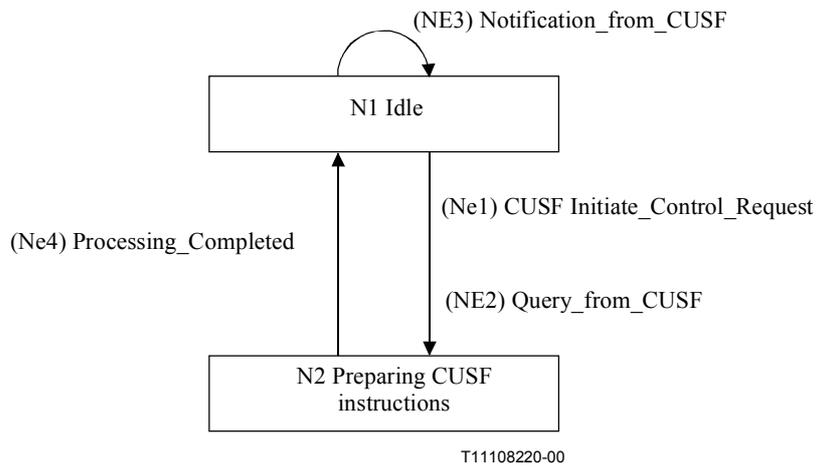
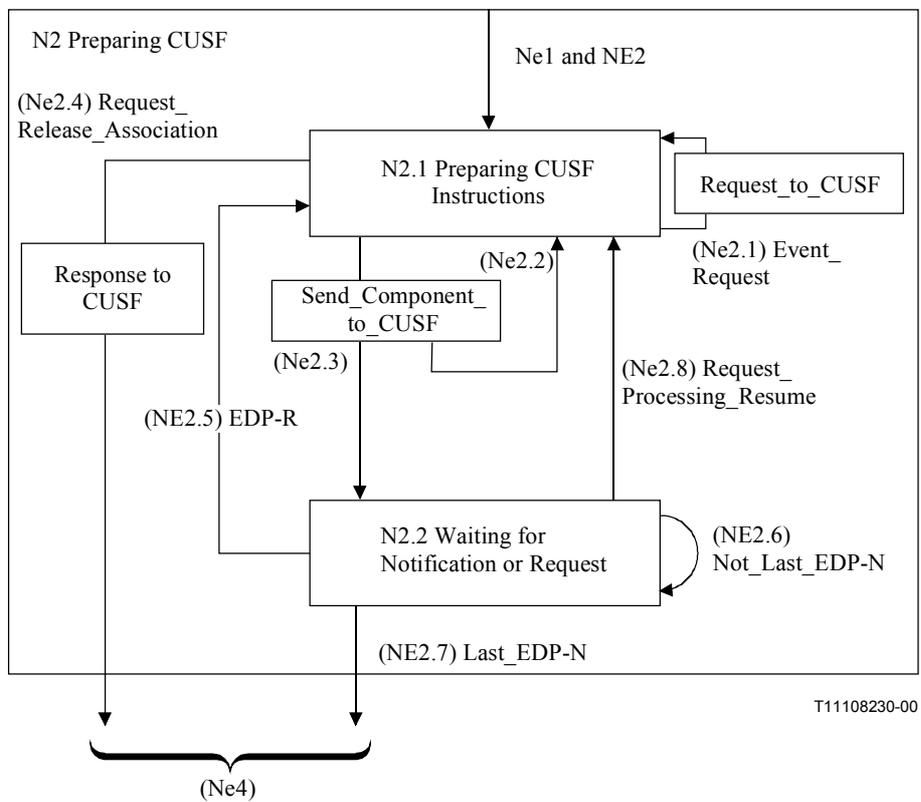


Figure 7/Q.1238.7 – SCSM: FSM for CUSF



NOTE – (Ne2.2) Request_Send_Component (monitor not required)
 (Ne2.3) Request_Send_Component (monitor required)

Figure 8/Q.1238.7 – SCSM: Sub-states of state N2

9 FSM for USI

9.1 Overview

A generic transport mechanism (transparent at the CUSF level) for the exchange of information between the User and the Service Logic is supported based on INAP operations, respectively SendSTUI in the "SCF-to-User" direction and ReportUTSI in the "User-to-SCF" direction. These user informations (USI) are composed of two elements (parameters) which are USIServiceIndicator and USIInformation. The first parameter identifies the IN Service Logic invoked while the second carries useful information between the User/Service Logic and the Service Logic.

Refer to ITU-T Q.1238.1 for a definition of the term "User" in the context of the Out-Channel Call-Unrelated User Interaction (OCCUUI) mechanism. A User to Service Information (USI) refers to either a UTSI or an STUI.

In the "SCF-to-User" direction, once the CUSF receives an STUI from the SCF within the SendSTUI operation, the CUSF forwards it to the appropriate user application in the network, e.g. an ISDN user. This User is clearly and easily defined by the Association Reference (indicated by the down-lower protocols) and the legID parameter (indicated by the INAP protocol).

In the "User-to-SCF" direction, the CCF/CUSF decides whether it forwards the USI information received from a User to the succeeding/preceding exchange or it passes it to a specific IN service. The received USI information is either of the following two cases:

Case 1) The USI information is considered as a "notification event" previously requested by the SCF. In this case, there is already a CUSF-SCF relationship.

Case 2) The USI information is an additional information. In this case, it is only an optional information.

The CUSF addresses the appropriate SCF based upon the ServiceIndicator parameter which is received within the USI. The *ServiceIndicator* value is indicated by the User (e.g. ISDN User) or by the Service Logic:

- If the SCF has initiated the USI dialogue, the User sets the *ServiceIndicator* value of the USI to the *ServiceIndicator* value as requested by the SCF. This scenario corresponds to the first case.
- If the user sends a USI without having previously received an STUI from the SCF, then it initializes the *ServiceIndicator* value of the USI with a predefined value. This scenario corresponds to the second case.

9.1.1.1 Case 1

In this case, the CUSF communicates with the SCF during an already existing SCF-CUSF relationship; the SCF initiates the "Out-Channel" dialogue with the User sending an STUI within the SendSTUI operation. Both SCF and CUSF behaviour can be described as above:

- Independently from the BCUSM processing, the SCF instructs the CUSF with the RequestReportUTSI operation to report to it all the USI information with a given *ServiceIndicator* value.
- Then, once it receives a USI, the CCF/CUSF compares the *ServiceIndicator* value received with the previously indicated *ServiceIndicator* value. If they coincide, then the CUSF reports the USI to the SCF with the ReportUTSI operation.

In this case, the required *ServiceIndicator* value is explicitly indicated by the SCF and stored at the CUSF level; this data is in a table associated with the CUSF USI FSM.

NOTE – The STUI/UTSI is conveyed in the appropriate signalling message (Basic Call Unrelated Control signalling message or Facility message) depending on the phase of the association on the dedicated leg (e.g. on the BCUSM processing).

9.1.1.2 Case 2

The USI information does not impact the usual DP processing. The USI is only an optional parameter that the CUSF introduces in the following operations after analysing the corresponding *ServiceIndicator* value to make sure that the received USI is targeted to this particular Service Logic.

- InitialAssociationDP.
- DP Specific operations.

The CUSF checks if the *ServiceIndicator* value of the USI coincides with the *ServiceIndicator* value contained within the Service related data table (trigger table).

NOTE – The STUI/UTSI is conveyed in the appropriate signalling message (Basic Call Unrelated Control signalling message or Facility message) depending on the phase of the call on the dedicated leg (e.g. on the BCUSM processing).

9.1.1.3 Synthesis

Table 4/Q.1238.7 – Synthesis of OCCUUI conditions

| Scenario | USI FSM | Service Indicator indicated by the User | Service Indicator value of reference | Operation sent to the SCF |
|------------------------------|----------------|---|--|--|
| USI dialogue | Monitoring USI | Indicated in the STUI <i>Dynamic</i> | Stored in the data table associated with the CUSF USI FSM | ReportUTSI |
| USI = additional information | Idle | Pre-defined | Explicitly indicated in the IN related data table of the IN service <i>Static in the CUSF</i> | - InitialAssociationDP - DP specific operations |

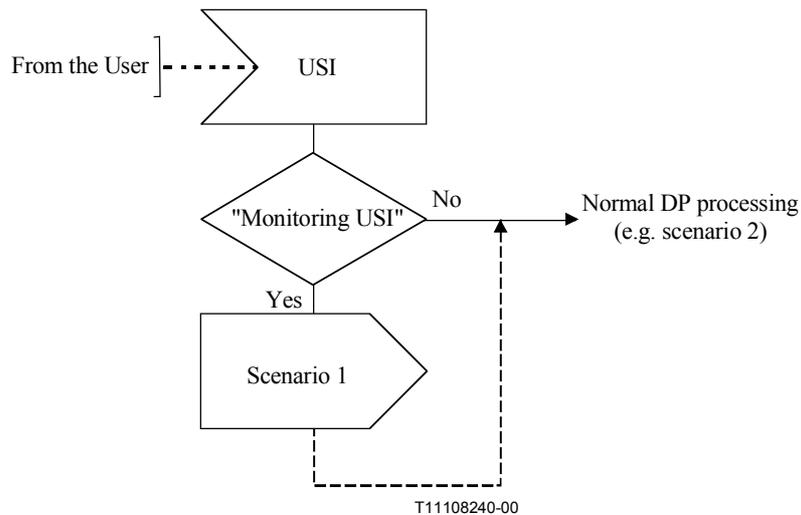


Figure 9/Q.1238.7 – SDL for OCCUUI processing in CUSF

9.2 SCF USI FSM for CUSF

The SCF USI FSM in this clause specifies USI related state transitions in SCF in a CUSF-SCF relationship. The SCF USI FSM instance exists in any state except when the FSM instance for CUSF in SCF (refer to 8.3) is in the Idle state.

The SCF USI FSM is depicted in Figure 10.

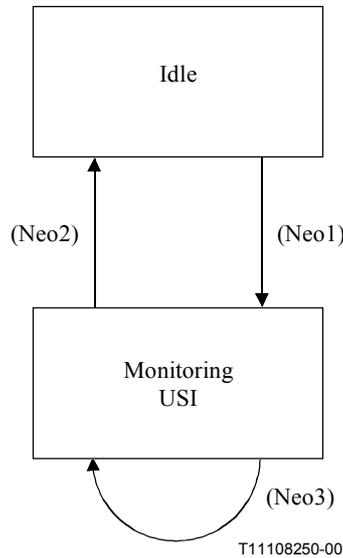


Figure 10/Q.1238.7 – SCF USI FSM

The SCF USI FSM transitions are defined as follows:

- (Neo1): the SCF requests the CUSF to monitor the receipt of a USI with a given *USIServiceIndicator* value by sending a RequestReportUTSI operation.
- (Neo2): the SCF is no longer interested in the receipt of a USI with the given *USIServiceIndicator* value. The SCF sends a RequestReportUTSI operation with the *uSImonitorMode* parameter set to "monitoringInactive".
- (Neo3): the SCF sends a SendSTUI operation to the User and/or receives a ReportUTSI operation from the User with the given *USIServiceIndicator* value.

9.3 CUSF USI FSM

The CUSF USI FSM specifies USI related state transitions in CUSF in a CUSF-SCF relationship. The CUSF USI FSM instance exists only in any state except when the FSM instance for CUSF (refer to 7.2) is in the Idle state.

The CUSF USI FSM is the same FSM as defined in ITU-T Q.1238.2 (SSF USI FSM) by replacing "SSF" with "CUSF".

10 Operation procedures

All the parameters in subclause "Parameters" are defined in clause 11.

10.1 ActivationReceivedAndAuthorized procedure

10.1.1 General description

This operation is sent by the CUSF to the SCF after detecting a valid trigger condition at the BCUSM ActivationReceivedAndAuthorized DP. This operation can be available in the following three cases.

- Case 1) TDP is detected by receiving a FACILITY information element (a ROSE APDU) from the user (refer to 5.4 for modelling). In this case, component related parameters (componentType, component, and componentCorrelationID) are sent with this operation. The service ASE is located in the SCF, and the CUSF acts as a relay function between the user and the SCF. The SCF may send ROSE APDU informations and receive further ROSE APDU informations.
- Case 2) TDP is detected by receiving a USI information. In this case, USI related parameters (uSIServiceIndicator and uSIInformation) are sent with this operation. The service ASE is located in the SCF, and the CUSF acts as a relay function between the user and the SCF. The SCF may send USI informations and receive further USI informations.
- Case 3) TDP is detected when a service ASE located in the CCF (BCUSM) needs further information to establish a bearer independent association. In this case, cUApplicationInd parameter and other connection related parameters (calledPartyNumber, genericNumbers, etc.) are sent with this operation. The CUSF acts as a relay function between the service ASE and the SCF. The SCF provides additional information for the association processing.

10.1.2 Parameters

10.1.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- callUnrelatedDPSPpecificCommonParameters:
 - serviceAddressInformation:
 - serviceKey;
 - miscCallInfo:
 - messageType:

When the messageType is "request", the TDP or EDP is reported as a request which means that the call unrelated processing is suspended for the SCF instructions. In EDP case, the message type for the EDP is requested by the RequestReportBCUSMEvent operation with monitorMode set to "interrupted".

When the messageType is "notification", the TDP or EDP is reported as a notification which means that the call unrelated processing is not suspended for the SCF instructions. In EDP case, the message type for the EDP is requested by the RequestReportBCUSMEvent operation with monitorMode set to "notifyAndContinue".
 - dPAssignment:

This sub-parameter is used only for TDP.
 - triggerType;
 - callingPartyNumber;
 - locationNumber;
 - terminalType;
 - extensions;

- uSIServiceIndicator;
- uSIIInformation;
- cUApplicationInd;
- calledPartyNumber;
- callingPartySubaddress;
- highLayerCompatibility;
- bearerCapability:

This parameter consists of the following alternatives:

– bearerCap

or

– tmr;

- genericNumbers;

– componentType:

This indicates the type of ROSE component that is received from a user and reported to the SCF. The value of "invoke" can only be available.

– componentCorrelationID;

– extensions;

– component.

10.1.3 Invoking entity (CUSF)

10.1.3.1 Normal procedure

CUSF Precondition (TDP):

- 1) CUSF-FSM is in state a: Idle.
- 2) An event fulfilling the criteria for the TDP has been detected. The event is one of three cases in 10.1.

CUSF Postcondition:

- 1) CUSF-FSM moves to state b: Waiting for Instructions if TDP-R.
- 2) CUSF-FSM remains in state a: Idle if TDP-N.

10.1.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.1.4 Responding entity (SCF)

10.1.4.1 Normal procedure

SCF Precondition (TDP):

– FSM for CUSF within the SCF is in the state N1: Idle.

SCF Postcondition (TDP-R):

- 1) FSM for CUSF within the SCF moves to state N2: Preparing CUSF Instructions.
- 2) Waiting for the request from the SLPI and CUSF instructions is being prepared.

SCF Postcondition (TDP-N):

– FSM for CUSF within the SCF remains in state a: Idle.

10.1.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.2 ActivityTest procedure

10.2.1 General description

This operation is used to check for the continued existence of a relationship between the SCF and the CUSF. If the relationship is still in existence, then the CUSF will respond. If no reply is received within a given time period, then the SCF which sent this operation will assume that the CUSF has failed in some way and will take the appropriate action.

10.2.2 Parameters

10.2.2.1 Argument parameters

None.

10.2.2.2 Result parameters

None.

10.2.3 Invoking entity (SCF)

10.2.3.1 Normal procedure

SCF Preconditions:

- 1) A relationship exists between the SCF and the CUSF.
- 2) The activity test timer (Tati) expires, after which the "ActivityTest" operation is sent to the remote entity.
- 3) The SCME is in state "Activity Test Idle".

SCF Postcondition:

- The SCME is in the state "Waiting for Activity Test Response". If a Return Result "ActivityTest" is received, the SCME resets the activity test timer, returns to state "Activity Test Idle", and takes no further action.

10.2.3.2 Error handling

Refer to the error handling of the ActivityTest operation procedure in ITU-T Q.1238.2.

10.2.4 Responding entity (CUSF)

10.2.4.1 Normal procedure

CUSF Precondition:

- A relationship exists between the SCF and the CUSF.

CUSF Postconditions:

- if the dialogue ID is active and if there is an FSM for CUSF using the dialogue, the CUSME-Control sends a Return Result "ActivityTest" to the SCF; or
if the dialogue ID is not active, the TCAP in the CUSF will issue a P-Abort; the CUSME-Control will in that case never receive the "ActivityTest" invocation and thus will not be able to reply.

10.2.4.2 Error handling

Operation-related error handling is not applicable, due to class 3 operation.

10.3 AssociationReleaseRequested procedure

10.3.1 General description

This operation is sent by the CUSF to the SCF after detecting a valid trigger condition at the BCUSM AssociationReleaseRequested DP (reported as TDP) or after detecting a previously requested event with RequestReportBCUSMEvent operation (reported as EDP). This operation can be available in the following three cases.

Case 1) TDP/EDP is detected by receiving a FACILITY information element (a ROSE APDU) from the user (refer to 5.4 for modelling). In this case, component related parameters (componentType, component, and componentCorrelationID) are sent with this operation. The service ASE is located in the SCF, and the CUSF acts as a relay function between the user and the SCF. The SCF may send ROSE APDU informations and receive further ROSE APDU informations.

Case 2) TDP is detected by receiving a USI information. In this case, USI related parameters (uSIServiceIndicator and uSIInformation) are sent with this operation. The service ASE is located in the SCF, and the CUSF acts as a relay function between the user and the SCF. The SCF may send USI informations and receive further USI informations.

Case 3) TDP/EDP is detected by requesting from a service ASE located in the CCF (BCUSM) for needing further information to establish a bearer independent association. In this case, cUApplicationInd parameter and other connection related parameters (calledPartyNumber, genericNumbers, etc.) are sent with this operation. The CUSF acts as a relay function between the service ASE and the SCF. The SCF provides additional information for the association processing.

10.3.2 Parameters

10.3.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- callUnrelatedDPSpecificCommonParameters:
Refer to ActivationReceivedAndAuthorized procedure for the sub-parameters usage in this parameter.
- componentType:
This parameter indicates the type of ROSE component that is received from a user and reported to the SCF. For example, the "invoke" is used to report the invocation of an operation from the user, and the "returnResult" is used to report the return result to the previously issued operation to the user by using a SendComponent operation from the SCF.
- componentCorrelationID;
- extensions;
- component;
- legID:
The alternative "receivingSideID" is only used in this operation. If this parameter is absent, the default value is assumed based on how the association has been initiated. In case of an SCF initiated association by InitiateAssociation operation and an EDP is reported, legID = 2, otherwise, legID = 1.

10.3.3 Invoking entity (CUSF)

10.3.3.1 Normal procedure

CUSF Precondition (TDP):

- 1) CUSF-FSM is in the state a: Idle.
- 2) The association establishment request is received from the user, and the component portion of the FACILITY IE meets the triggering criteria (optional).

CUSF Precondition (EDP):

- 1) CUSF-FSM is in the state c: Monitoring.
- 2) The operation invocation request is received from the user, and the component portion of the FACILITY IE meets the event report criteria (optional).

CUSF Post condition (1) or 2)):

- 1) CUSF-FSM moves to state b: Waiting for Instructions (TDP-R or EDP-R).
- 2) CUSF-FSM remains in or moves to state a: idle (TDP-N or last EDP-N).
- 3) CUSF-FSM remains in state c: Monitoring (not last EDP-N).

10.3.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.3.4 Responding entity (SCF)

10.3.4.1 Normal procedure

SCF Precondition (TDP):

- FSM for CUSF (SCSM-CUSF) is in state N1: Idle.

SCF Precondition (EDP):

- FSM for CUSF (SCSM-CUSF) is in state N2.2: Waiting for Notification of Request.

SCF Postcondition:

- 1) FSM for CUSF (SCSM-CUSF) moves to state N2: Preparing CUSF Instructions (TDP-R or EDP-R).
- 2) FSM for CUSF (SCSM-CUSF) remains in or moves to state a: Idle (TDP-N or last EDP-N).
- 3) FSM for CUSF (SCSM-CUSF) remains in state c: Waiting for Notification or Request (not last EDP-N).
- 4) Waiting for the request from the SLPI and CUSF instructions is being prepared.

10.3.4.2 Error handling

Generic error handling for the operation-related errors is described in 12, and the TC services which are used for reporting operation errors are described in 14.

10.4 ComponentReceived procedure

10.4.1 General description

This operation is sent by the CUSF to the SCF after detecting valid trigger conditions at the BCUSM ComponentReceived DP (reported as TDP) or after detecting a previously requested event with RequestReportBCUSMEvent operation (reported as EDP). This operation can be available in the three cases described in 10.3.

10.4.2 Parameters

10.4.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- callUnrelatedDPSSpecificCommonParameters:
Refer to ActivationReceivedAndAuthorized procedure for the sub-parameters usage in this parameter.
- componentType:
Refer to AssociationReleaseRequested operation procedure for the usage of this parameter.
- componentCorrelationID;
- extensions;
- component;
- legID.
Refer to AssociationReleaseRequested operation procedure for the usage of this parameter.

10.4.3 Invoking entity (CUSF)

10.4.3.1 Normal procedure

CUSF Precondition (TDP):

- 1) CUSF-FSM is in state a: Idle.
- 2) The association has been established between the user and the network.
- 3) The operation invocation request is received from the user, and the component portion of the FACILITY IE meets the triggering criteria (optional).

CUSF Precondition (EDP):

- 1) CUSF-FSM is in state c: Monitoring.
- 2) The operation invocation request is received from the user, and the component portion of the FACILITY IE meets the event report criteria (optional).

CUSF Post condition (1) or 2)):

- 1) CUSF-FSM moves to state b: Waiting for Instructions (TDP-R or EDP-R).
- 2) CUSF-FSM remains in or moves to state a: Idle (TDP-N or last EDP-N).
- 3) CUSF-FSM remains in state c: Monitoring (not last EDP-N).

10.4.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.4.4 Responding entity (SCF)

10.4.4.1 Normal procedure

SCF Precondition (TDP):

- FSM for CUSF (SCSM-CUSF) is in state N1: Idle.

SCF Precondition (EDP):

- FSM for CUSF (SCSM-CUSF) is in state N2.2: Waiting for Notification of Request.

SCF Post condition:

- 1) FSM for CUSF (SCSM-CUSF) moves to state N2.1: Preparing CUSF Instructions (TDP/EDP-R).
- 2) FSM for CUSF (SCSM-CUSF) remains in or moves to state N1: Idle (TDP-N or last EDP-N).
- 3) FSM for CUSF (SCSM-CUSF) remains in state N2.2: Waiting for Notification or Request (not last EDP-N).

10.4.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.5 ConnectAssociation procedure

10.5.1 General description

This operation is used to request the CUSF to proceed with processing. Additional information which shall be used in further association establishment is provided by the SCF.

CUSF continues association establishment (connection-oriented bearer independent transport) to the specified destination using the address information received from the SCF. A two-party association between the originating user/network application and the terminating user/network application is established. The communication path toward each of the user/network applications is identified by leg ID. If the release request event is received from the terminating user/network, then a follow-on association establishment is allowed.

10.5.2 Parameters

10.5.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- address;
- genericNumbers;
- extensions.

10.5.3 Invoking entity (SCF)

10.5.3.1 Normal procedure

SCF Precondition:

- 1) FSM for CUSF (SCSM-CUSF) is in state N2: Preparing CUSF Instructions.
- 2) The SLPI has determined that a "ConnectAssociation" has to be sent by the SCF.

SCF Postcondition:

- FSM for CUSF (SCSM-CUSF) moves to state N1: Idle, if monitoring is not required, or moves to state N2.2: Waiting for Notification or Request, if monitoring is required.

NOTE – The information provided by the SCF depends on the service ASE located in the CUSF.

10.5.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.5.4 Responding entity (CUSF)

10.5.4.1 Normal procedure

CUSF Precondition:

- 1) Bearer unrelated association processing has been suspended at a DP.
- 2) CUSF-FSM is in the state b: Waiting for Instructions.

CUSF Postcondition:

- 1) CUSF continues association establishment (connection-oriented bearer independent transport) to the specified destination using additional information from the SCF. A two-party association is established.
- 2) CUSF-FSM moves to state a: Idle, if monitoring is not required, or to state c: Monitoring, if monitoring of BCUSM events was requested in a previous operation.
- 3) CUSF-FSM processing is resumed.

On receipt of this operation in the CUSF FSM state b: Waiting for Instructions, the CUSF performs following action:

- The CUSF cancels T_{CUSF} .

10.5.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.6 ContinueAssociation procedure

10.6.1 General description

This operation is used to request the CUSF to proceed with processing. Additional information which is not related to further association establishment may be provided by the SCF. The SCF shall send either a SendComponent or a ContinueAssociation operation to request the CUSF to continue the call unrelated processing from the suspended DP.

CUSF continues association establishment (connection-oriented bearer independent transport) for the implied destination using any address information available in the BCUSM. A two-party or a one-party association between an originating user/network application and a terminating user/network application is established depending on the location of the termination point for the concerned service application. For example, a one-party association may be established between the SCF representing the terminating ASE and a user/application in the network representing the originating ASE. The communication path toward user/network application is identified by leg ID.

10.6.2 Parameters

10.6.2.1 Argument parameters

The operation argument consists of the following parameter.

- extensions.

10.6.3 Invoking entity (SCF)

10.6.3.1 Normal procedure

SCF Precondition:

- 1) FSM for CUSF (SCSM-CUSF) is in state N2: Preparing CUSF Instructions.
- 2) The SLPI has determined that a "ContinueAssociation" has to be sent by the SCF.

SCF Postcondition:

- 1) FSM for CUSF (SCSM-CUSF) moves to state N1: Idle, if monitoring is not required, or moves to state N2.2: Waiting for Notification or Request, if monitoring is required.
- 2) FSM for CUSF (SCSM-CUSF) resumes processing from the current DP where processing was suspended.
- 3) If address information is available in the BCUSM to be used in further association establishment a two-party association is set up, otherwise a one party association set up applies.

NOTE – The information provided by the SCF depends on the service ASE located in the CCF (BCUSM).

10.6.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.6.4 Responding entity (CUSF)

10.6.4.1 Normal procedure

CUSF Precondition:

- 1) Bearer unrelated association processing has been suspended at a DP.
- 2) CUSF-FSM is in state b: Waiting for Instructions.

CUSF Postcondition:

- 1) CUSF continues association establishment (connection-oriented bearer independent transport).
- 2) CUSF-FSM moves to the state a: Idle, if monitoring is not required, or to state c: Monitoring, if monitoring of BCUSM events was requested in a previous operation.

On receipt of this operation in the CUSF FSM state b: Waiting for Instructions, the CUSF performs following action:

- The CUSF cancels T_{CUSF} .

10.6.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.7 EventReportBCUSM procedure

10.7.1 General description

This operation is used to notify the SCF of a call unrelated event previously requested by the SCF in an "RequestReportBCUSMEvent" operation. The monitoring of more than one event could be requested with a "RequestReportBCUSMEvent" operation, but each of these requested events is reported in a separate "EventReportBCUSM" operation. This operation can be available in the following two cases.

Case 1) EDP is detected by receiving a FACILITY information element (a ROSE APDU) from the user (refer to 5.4 for modelling). In this case, component-related parameters (componentType, component, and componentCorrelationID) are sent with this operation. The service ASE is located in the SCF, and the CUSF acts as a relay function between the user and the SCF. The SCF may send ROSE APDU informations and receive further ROSE APDU informations.

Case 2) EDP is detected by requesting from a service ASE located in the CCF (BCUSM) for needing further information to establish a bearer independent association. The CUSF acts as a relay function between the service ASE and the SCF. The SCF provides additional information for the association processing.

10.7.2 Parameters

10.7.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

– eventTypeBCUSM;

– eventSpecificInformationBCUSM:

This parameter consists of the following alternatives:

- bearerCap

or

- tmr;

– miscCallInfo:

The sub-parameter "dpAssignment" is not used in this operation.

- messageType:

When the messageType is "request", the EDP is reported as a request which means that the call unrelated processing is suspended for the SCF instructions. The message type for the EDP is requested by the RequestReportBCUSMEvent operation with monitorMode set to "interrupted".

When the messageType is "notification", the EDP is reported as a notification which means that the call unrelated processing is not suspended for the SCF instructions. The message type for the EDP is requested by the RequestReportBCUSMEvent operation with monitorMode set to "notifyAndContinue";

– cUApplicationInd;

– legID:

The alternative "receivingSideID" is only used in this operation. If this parameter is absent, the default value is assumed based on how the association has been initiated. In case of an SCF initiated association by InitiateAssociation operation, legID = 2, otherwise, legID = 1;

– componentType:

Refer to AssociationReleaseRequested operation procedure for the usage of this parameter;

– componentCorrelationID;

– component;

– extensions.

10.7.3 Invoking entity (CUSF)

10.7.3.1 Normal procedure

CUSF Preconditions:

- 1) The CUSF FSM is in state c: Monitoring.
- 2) The BCUSM proceeds to an EDP that is armed.

CUSF Postconditions:

- 1) The CUSF FSM stays in state c: Monitoring, if the message type was notification and there are still EDPs armed.
- 2) The CUSF FSM moves to state a: Idle, if the message type was notification and there are no more EDPs armed.
- 3) The CUSF FSM moves to state b: Waiting for Instructions, if the message type was request. Bearer independent association processing is interrupted.

10.7.3.2 Error handling

In case the message type is request, on expiration of T_{CUSF} before receiving any operation, the CUSF aborts the interaction with the SCF.

Operation-related error handling is not applicable, due to class 4 operation.

10.7.4 Responding entity (SCF)

10.7.4.1 Normal procedure

SCF Preconditions:

- FSM for CUSF (SCSM-CUSF) is in state N2: Preparing CUSF Instructions, sub-state N2.2: Waiting for Notification or Request.

SCF Postconditions:

- 1) FSM for CUSF (SCSM-CUSF) remains in the sub-state N2.2: Waiting for Notification or Request, if the message type was notification and there are still EDPs armed; or
FSM for CUSF (SCSM-CUSF) moves to the state N1: Idle, if the message type was notification and there are no more EDPs armed; or
FSM for CUSF (SCSM-CUSF) moves to sub-state N2.1: Preparing CUSF Instructions, if the message type was request.
- 2) The event is reported to a SLPI, based on the dialogue ID. The SCF will prepare CUSF instructions in accordance with the SLPI.

10.7.4.2 Error handling

Operation-related error handling is not applicable, due to class 4 operation.

10.8 InitialAssociationDP procedure

10.8.1 General description

This operation is sent by the CUSF to the SCF after detecting a valid trigger condition at a BCUSM DP (reported as TDP). This operation can be available in the three cases described in 10.1.

10.8.2 Parameters

10.8.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- serviceKey;
- cUApplicationInd:
If this parameter exists, both uSIServiceIndicator and uSIIInformation parameters shall not be used;

- miscCallInfo:
 - messageType:
 - When the messageType is "request", the TDP is reported as a request which means that the call unrelated processing is suspended for the SCF instructions.
 - When the messageType is "notification", the TDP is reported as a notification which means that the call unrelated processing is not suspended for the SCF instructions;
- dPAssignment–eventTypeBCUSM;
- calledPartyNumber;
- callingPartyNumber;
- callingPartySubaddress;
- highlayerCompatibility;
- bearerCapability;
- uSIServiceIndicator:
 - If this parameter exists, the cUApplicationInd parameter shall not be used;
- uSIIInformation:
 - If this parameter exists, the cUApplicationInd parameter shall not be used;
- genericNumbers;
- componentType:
 - Refer to ActivationReceivedAndAuthorized procedure when the ActivationReceivedAndAuthorized TDP is detected and AssociationReleaseRequested operation procedure when the other TDP is detected for the usage of this parameter;
- componentCorrelationID;
- component;
- extensions.

10.8.3 Invoking entity (CUSF)

10.8.3.1 Normal procedure

CUSF Precondition:

- 1) CUSF-FSM is in state a: Idle.
- 2) The association has been established between the user and the network.
- 3) An event fulfilling the criteria for the DP being executed has been detected.

CUSF Postcondition:

- 1) CUSF-FSM moves to state b: Waiting for Instructions (TDP-R).
- 2) CUSF-FSM remains in or moves to the state a: Idle (TDP-N).

NOTE – The information provided to the SCF depends on the service ASE located in the CUSF (case 1).

If the DP was armed as a TDP-R, a control relationship is established to the SCF. The CUSF application timer T_{CUSF} is set when the CUSF sends "InitialAssociationDP" for requesting instructions from the SCF. It is used to prevent excessive call suspension time.

10.8.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.8.4 Responding entity (SCF)

10.8.4.1 Normal procedure

SCF Precondition:

- FSM for CUSF (SCSM-CUSF) is in state N1: Idle.

SCF Postcondition:

- 1) FSM for CUSF (SCSM-CUSF) moves to state N2.1: Preparing CUSF Instructions (TDP-R)
- 2) FSM for CUSF (SCSM-CUSF) remains in state N1: Idle (TDP-N).

10.8.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.9 InitiateAssociation procedure

10.9.1 General description

This operation is used to allow the SCF to initiate a call unrelated association with the user.

10.9.2 Parameters

10.9.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- calledPartyNumber;
- extensions;
- uSIServiceIndicator;
- uSIInformation;
- genericNumbers.

10.9.2.2 Result parameters

None.

10.9.3 Invoking entity (SCF)

10.9.3.1 Normal procedure

SCF Precondition:

- 1) FSM for CUSF (SCSM-CUSF) is in state N1: Idle.
- 2) SLPI requests to initiate a call unrelated association with the user.

SCF Postcondition:

- FSM for CUSF (SCSM-CUSF) prepares to send a component or USI information to the user and goes to state N2: Preparing CUSF Instructions.

The SLPI shall send either a "SendComponent" or a "ContinueAssociation" operation to request the CCF/CUSF to continue the call unrelated processing from the suspended DP.

10.9.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.9.4 Responding entity (CUSF)

10.9.4.1 Normal procedure

CUSF Precondition:

- CUSF-FSM is in state a: Idle.

CUSF Postcondition:

- 1) CUSF-FSM goes to state b: Waiting for Instructions.
- 2) A Return Result is sent.

The BCUSM is instantiated and suspended at the ActivationReceivedAndAuthorized DP. The CUSF is waiting for subsequent instructions from the SCF.

10.9.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.10 ReleaseAssociation procedure

10.10.1 General description

This operation is used by the SCF to release an existing association.

10.10.2 Parameters

Argument parameters

The operation argument consists of the following parameter. This parameter is defined in clause 11.

- cause.

This parameter indicates the reason why the SCF releases the association and may be used by CUSF to fill in the "cause" in the association releasing message.

10.10.3 Invoking entity (SCF)

10.10.3.1 Normal procedure

SCF Precondition:

- 1) FSM for CUSF (SCSM-CUSF) is in state N2: Preparing CUSF Instructions.
- 2) SLPI requests to release the association between the user and the network.

SCF Postcondition:

- FSM for CUSF (SCSM-CUSF) moves to state N1: Idle.

10.10.3.2 Error handling

Operation-related error handling is not applicable, due to class 4 operation.

10.10.4 Responding entity (CUSF)

10.10.4.1 Normal procedure

CUSF Precondition:

- CUSF-FSM is in state b: Waiting for Instructions.

CUSF Postcondition:

- 1) CUSF releases the association with association release message which may contain previously specified component (by SendComponent) to the user.

2) CUSF-FSM moves to state a: Idle.

10.10.4.2 Error handling

Operation-related error handling is not applicable, due to class 4 operation.

10.11 ReportUTSI procedure

10.11.1 General description

This operation is used to notify the SCF of a USI previously requested by the SCF in a *RequestReportUTSI* operation.

NOTE – Refer to ITU-T Q.1238.1 for a definition of the term "User" in the context of the OCCUI mechanism.

A *User to Service Information (USI)* refers to either a UTSI or an STUI.

10.11.2 Parameters

10.11.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- uSIServiceIndicator;
- legID;
- uSIInformation;
- extensions.

10.11.3 Invoking entity (CUSF)

10.11.3.1 Normal procedure

CUSF preconditions:

- 1) The CUSF FSM is in any state except "Idle".
- 2) The CUSF_USI FSM is in the state "Monitoring USI IE".

CUSF Postconditions:

- 1) The CUSF FSM remains in the same state.
- 2) The CUSF_USI FSM remains in the same state.

10.11.3.2 Error handling

Operation-related error handling is not applicable, due to class 4 operation.

10.11.4 Responding entity (SCF)

10.11.4.1 Normal procedure

The procedure is same as that of the corresponding operation procedure in ITU-T Q.1238.2 by replacing the "SSF" with the "CUSF".

10.11.4.2 Error handling

Operation-related error handling is not applicable, due to class 4 operation.

10.12 RequestReportBCUSMEvent procedure

10.12.1 General description

This operation requests the CUSF to report the reception of the ROSE APDU from the user (optionally a ROSE APDU information pattern, e.g. FACILITY IE pattern, is specified as a DP criteria) or requests the CUSF to monitor for call unrelated events matching the requested criteria.

Table 5/Q.1238.7 – DP arming table for BCUSM

| BCUSM | Controlling leg | Passive leg |
|--|-----------------|-------------|
| Activation_Received_And_Authorized DP (see Note) | – | – |
| Component_Received DP | X | X |
| Association_Release_Requested DP | X | X |
| X Arming applicable – Not Applicable NOTE – Only applicable as TDP, because first DP that can be encountered cannot be armed as EDP. | | |

10.12.2 Parameters

10.12.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- bCUSMEvents;
- componentTypes:

This parameter indicates the one or more types of component that will be monitored. In case a specific componentType is provided, this operation is used to request the CUSF to report the reception of invocation of an operation or a result from the side of the association, which is indicated by the legID sub-parameter, to the SCF. The requesting event(s) can be either an invocation, the return result, return error, or reject from the indicated side. For example, "return result" is used to request the CUSF reporting the result of the previous invocation of an operation from the SCF;

- componentCorrelationID;
- monitorDuration;
- extensions;
- cUDPCriteria;
- legID:

The alternative "sendingSideID" is only used in this operation. If this parameter is absent, the default value is assumed based on how the association has been initiated. In case of an SCF initiated association by InitiateAssociation operation, legID = 2, otherwise, legID = 1.

10.12.3 Invoking entity (SCF)

10.12.3.1 Normal procedure

SCF Precondition:

- 1) FSM for CUSF (SCSM-CUSF) is in state N2.1: preparing CUSF instructions.
- 2) SLPI requests to monitor the reception of a component form the user or requests to monitor for call unrelated events matching the requested criteria.

SCF Postcondition:

- FSM for CUSF (SCSM-CUSF) remains in the same state N2.1: preparing CUSF instructions.

10.12.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.12.4 Responding entity (CUSF)

10.12.4.1 Normal procedure

CUSF Precondition:

- CUSF-FSM is in state b: Waiting for Instructions.

CUSF Postcondition:

- 1) CUSF starts the monitoring process for the specified event(s) or clears the armed EDP(s).
- 2) CUSF-FSM remains in the same state.
- 3) Requested events are monitored until the EDPs are detected or until the monitor duration is elapsed.

10.12.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.13 RequestReportUTSI procedure

10.13.1 General description

This operation is used to request the CUSF to monitor for the receipt of a USI IE with a given *ServiceIndicator* value, then send this USI IE back to the SCF when this IE is received.

NOTE – Refer to ITU-T Q.1238.1 for a definition of the term "User" in the context of the OCCUUI mechanism.

A User to Service Information (USI) IE refers to either a UTSI IE or an STUI IE.

10.13.2 Parameters

10.13.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- requestedUTSIList;
- extensions;
- legID.

10.13.3 Invoking entity (SCF)

10.13.3.1 Normal procedure

The procedure is same as that of the corresponding operation procedure in ITU-T Q.1238.2 by replacing the "SSF" with the "CUSF".

10.13.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.13.4 Responding entity (CUSF)

10.13.4.1 Normal procedure

CUSF Precondition:

- 1) The CUSF FSM is any state except "Idle".
- 2) The CUSF_USI FSM is in any state.

CUSF Postcondition:

- 1) The CUSF FSM remains in the same state.
- 2) The CUSF_USI FSM moves to the state "Monitoring USI" (if the USIMonitorMode is "monitoringActive") or to the state "Idle" (if the USIMonitorMode is "monitoringInactive").

10.13.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.14 SendComponent procedure

10.14.1 General description

This operation requests the CUSF to send the specified FACILITY information to the user.

10.14.2 Parameters

10.14.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- componentType:
This parameter indicates the type of component that will be delivered to the user. For example, "return result" is used to report the result of the previous invocation of an operation from a user;
- componentCorrelationID;
- message;
- monitorDuration;
- extensions;
- component:
This parameter indicates the component that will be delivered to the user.

10.14.3 Invoking entity (SCF)

10.14.3.1 Normal Procedure

SCF Precondition:

- 1) FSM for CUSF (SCSM-CUSF) is in state N2: Preparing CUSF Instructions.
- 2) SLPI requests to send the component to the user.

SCF Postcondition:

- FSM for CUSF (SCSM-CUSF) remains in state N2: Preparing CUSF Instructions if monitoring is not required or moves to state N2.2: Waiting for Notification or Request if monitoring is required.

10.14.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.14.4 Responding entity (CUSF)

10.14.4.1 Normal procedure

CUSF Precondition:

- CUSF-FSM is in state b: Waiting for Instructions.

CUSF Postcondition:

- 1) CUSF send specified component to the user with appropriate message, but if the association release message is specified to send the component, it will be cued until the association release request received.
- 2) CUSF-FSM remains in state b: Waiting for Instructions if an EDP is armed or moves to the state c: Monitoring.

10.14.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.15 SendSTUI procedure

10.15.1 General description

This operation is used to request the CUSF to forward an STUI with a given ServiceIndicator value to the User (indicated by leg ID).

NOTE – Refer to ITU-T Q.1238.1 for a definition of the term "User" in the context of the OCCUUI mechanism.

10.15.2 Parameters

10.15.2.1 Argument parameters

The operation argument consists of the following parameters. These parameters are defined in clause 11.

- uSIServiceIndicator;
- legID;
- uSIInformation;
- extensions.

10.15.3 Invoking entity (SCF)

10.15.3.1 Normal procedure

The procedure is same as that of the corresponding operation procedure in ITU-T Q.1238.2 by replacing the "SSF" with the "CUSF".

10.15.3.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

10.15.4 Responding entity (CUSF)

10.15.4.1 Normal procedure

CUSF Precondition:

- 1) The CUSF FSM is any state except "Idle".
- 2) The CUSF_USI FSM is in any state.

CUSF Postcondition:

- 1) The CUSF FSM remains in the same state.
- 2) The CUSF_USI FSM remains in the same state.

On receipt of this operation, the CUSF will forward the STUI IE to the User (identified by the LegID).

10.15.4.2 Error handling

Generic error handling for the operation-related errors is described in clause 12, and the TC services which are used for reporting operation errors are described in clause 14.

11 Parameters

This clause defines the parameters used in the operations procedures as specified in clause 10.

11.1 Address

This parameter contains the called party number to be used in the further association establishment (connection-oriented bearer independent transport). Refer to ITU-T Q.762 called party number for the actual definition of this parameter.

11.2 BCUSMEvents

This parameter specifies a list of (1 to n) requested BCUSM events and indicates how and which DP should be reported (DP name and report mode). Each BCUSM event comprises the following sub-parameters:

- eventTypeBCUSM:
This sub-parameter is identical to the EventTypeBCUSM parameter.
- monitorMode:
This sub-parameter is defined in ITU-T Q.1238.2.

11.3 BearerCapability

This parameter indicates the type of the bearer capability required for connection or the transmission medium requirements to the user. It comprises the following alternative sub-parameters and is a network option to select one of them to be used.

– bearerCap:

This alternative specifies the value of the DSS1 Bearer Capability parameter (ITU-T Q.931) in case the CUSF is at local exchange level or the value received in a TC message.

The parameter "bearerCapability" is included in an "InitialAssociationDP" or a DP specific operation in case the Bearer Capability parameter is available.

If two values for bearer capability are available at the CUSF or if User Service Information and User Service Information Prime are available at the CUSF, the "bearerCap" shall contain the value of the preferred bearer capability or the value of the User Service Information Prime parameter respectively.

or

– tnr:

For a definition of this sub-parameter, refer to ITU-T Q.1238.2.

Depending on the parameters of the feature specific operation, the BearerCapability can be retrieved from the operation, which builds up the association (in case of CCBS the BearerCapability is a mandatory part of the CCBS request).

11.4 CalledPartyNumber

This parameter contains the number used to identify the called party in the forward direction. Refer to ITU-T Q.762 for the actual definition of this parameter.

The CalledPartyNumber is available in the DSS1 IE (local exchange only) or can be retrieved from the feature specific operation, which builds up the association (e.g. in case of CCBS CalledNumber is a mandatory part of the CCBS request).

11.5 CallingPartyNumber

This parameter contains the address of the calling party. Refer to ITU-T Q.762 for the actual definition of this parameter.

The CallingPartyNumber is available in the DSS1 IE (local exchange only) or can be retrieved from the feature specific operation, which builds up the association (e.g. in case of CCBS CallingPartyNumber is an optional part of the CCBS request).

11.6 CallingPartySubaddress

This parameter contains the calling party subaddress provided either as a result of DSS1 or in a bearer unrelated (TC) signalling. Refer to ITU-T Q.931 for the actual definition of this parameter.

The CallingPartySubaddress is available in the DSS1 IE (local exchange only) or can be retrieved from the feature specific operation, which builds up the association (e.g. in case of CCBS CallingPartySubaddress is part of the optional parameter AccessTransport of the CCBS request).

This parameter contains information that may not have been checked by the network for coding errors.

11.7 CallUnrelatedDpSpecificCommonParameters

This parameter indicates the call unrelated DP specific information. It comprises the following sub-parameters:

- serviceAddressInformation:
This sub-parameter indicates the trigger related information. It comprises the following sub-parameters:
 - serviceKey:
This sub-parameter is identical to the ServiceKey parameter.
 - miscCallInfo:
This sub-parameter is identical to the MiscCallInfo parameter.
 - triggerType:
This sub-parameter indicates to the SCF the particular event which caused the detection of a valid trigger condition. For a definition of this sub-parameter, refer to ITU-T Q.1238.2.
- callingPartyNumber:
This sub-parameter is identical to the CallingPartyNumber parameter.
- locationNumber:
This sub-parameter indicates the Location Number for the calling party. Refer to ITU-T Q.762 for the actual definition of this parameter
- terminalType:
This is defined in ITU-T Q.1238.2. The absence of this parameter means that the terminal type is "ISDN".
- uSIServiceIndicator:
This sub-parameter is identical to the USIServiceIndicator parameter.
- uSIInformation:
This sub-parameter is identical to the USIInformation parameter.
- cUApplicationInd:
This sub-parameter is identical to the CUApplicationInd parameter.
- calledPartyNumber:
This sub-parameter is identical to the CalledPartyNumber parameter.
- callingPartySubaddress:
This sub-parameter is identical to the CallingPartySubaddress parameter.
- highLayerCompatibility:
This sub-parameter is identical to the HighLayerCompatibility parameter.
- bearerCapability:
This sub-parameter is identical to the BearerCapability parameter.
- genericNumbers:
This sub-parameter is identical to the GenericNumbers parameter.

11.8 Cause

This parameter indicates the reason of releasing the specific association. Refer to ITU-T Q.762 for the actual definition of this parameter.

11.9 Component

This parameter is derived from the UNI APDU or mapped to the UNI APDU depending on the transferring direction of this parameter (CUSF to SCF for the former and SCF to CUSF for the latter). The following alternatives are possible according to the data type, and one of them should be chosen.

Case 1) Component data type is an OCTETSTRING. It contains the operation value (object identifier) error value, etc. within the UNI APDU, and in addition also contains the parameter set/sequence for the operation invocation/return result or return error/reject on UNI. Refer to ITU-T Q.932 for the actual definition of this parameter.

Case 2) Component data type is an EMBEDDED-PDV. In this case, componentType and componentCorrelationID shall not be used.

11.10 ComponentCorrelationID

This parameter links the invoke ID that is used by the CUSF and the SCF with the invoke ID assigned between the user and the network locally. The value indicated in this parameter is used to correlate the response from the SCF (which will be done by SendComponent) within the CUSF.

11.11 ComponentType

This parameter indicates the type of ROSE component (invoke, return result, return error, and reject). This is derived from/to the UNI APDU or used for indicating the monitor condition.

11.12 ComponentTypes

This parameter specifies a list of (1 to n) requested component types. The component type is identical to the ComponentType parameter.

11.13 CUApplicationInd

This parameter identifies the triggered application [case service ASE located in the CCF (BCUSM)]. It is derived CUSF internally. This parameter shall indicate the operation code of the triggered application specific operation. Two types of values shall be supported: global values for standardized applications and local values for non-standardized applications.

11.14 CUDPCriteria

This parameter identifies the EDP criteria for the requested DP. This EDP criteria may correspond to the parameter component or cUApplicationInd in the "InitialAssociationDP" or DP specific operations.

When this parameter is provided, ComponentType and ComponentCorrelationID may not be used.

11.15 EventSpecificInformationBCUSM

This parameter indicates the call unrelated information according to the detected EDP. It comprises the following alternative sub-parameters:

– componentReceivedSpecificInfo:

This sub-parameter specifies the Component_Received EDP specific information. It comprises the following sub-parameter:

• componentReceivedInfo:

This sub-parameter indicates additional information about the component, but not the component itself.

or

– associationReleaseRequestedSpecificInfo:

This sub-parameter specifies the Association_Release_Requested EDP specific information. It comprises the following sub-parameters:

- associationReleaseInfo:

This sub-parameter indicates additional information about the component, but not the component itself.

- releaseCause:

This sub-parameter indicates the reason why the association is released. Refer to ITU-T Q.762 for the actual definition of this parameter.

11.16 EventTypeBCUSM

This parameter specifies the type of BCUSM DP event that is reported.

11.17 GenericNumbers

This parameter indicates one or more additional numbers and specifies a list of (1 to n) generic numbers. Refer to ITU-T Q.762 for the actual definition of each generic number.

Depending on the parameters of the feature specific operation the GenericNumber can be retrieved from the operation, which builds up the association.

11.18 HighLayerCompatibility

This parameter indicates the type of the high layer compatibility, which will be used to determine the ISDN – teleservice of a connected ISDN terminal. Refer to ITU-T Q.931 for the actual definition of this parameter.

The HighLayerCompatibility is available in the DSS1 IE (local exchange only) or can be retrieved from the feature specific operation, which builds up the association (e.g. in case of CCBS the HighLayerCompatibility is part of the optional parameter AccessTransport of the CCBS request).

11.19 LegID

This parameter indicates the side of the association for which an event is being reported or is to be monitored. It comprises the following alternative sub-parameters:

– sendingSideID:

This alternative indicates the leg ID assigned by the side which sends the operation.

or

– receivingSideID:

This alternative indicates the leg ID assigned by the side which receives the operation.

The CUSF uses the "receivingSideID" alternative only. The SCF uses the "sendingSideID" alternative only.

The leg numbering is based on the following principles:

– LegID = 1 is the controlling leg;

– LegID = 2 is the passive leg.

When a TDP is detected, the controlling leg corresponds to the initiating side of the association and the passive leg corresponds to the responding side. The outgoing signalling dialogue with the responding side is initiated by a ConnectAssociation or ContinueAssociation operation.

When an InitiateAssociation operation is used, the passive leg represents the responding side of the association. There is no controlling leg.

When the LegID parameter is absent from one of the following operations:

- AssociationReleaseRequested;
- ComponentReceived;
- EventReportBCUSM;
- RequestReportBCUSMEvent,

a default value is assumed based on how the association has been initiated. In case of an SCF initiated association by InitiateAssociation operation, legID = 2 is assumed, otherwise, legID = 1 is assumed.

11.20 Message

This parameter specifies the message (release, release complete, or facility) for delivering the component to the user.

11.21 MiscCallInfo

This parameter indicates the DP related information. It comprises the following sub-parameters:

- messageType:
This sub-parameter indicates whether the message is a "request" or a "notification".
- dPAssignment:
For a definition of this sub-parameter, refer to ITU-T Q.1238.2.

11.22 MonitorDuration

This parameter indicates how long the CUSF should monitor the component transmission result.

11.23 RequestedUTSIList

For a definition of this parameter, refer to ITU-T Q.1238.2.

11.24 ServiceKey

For a definition of this parameter, refer to ITU-T Q.1238.2.

11.25 USIInformation

For a definition of this parameter, refer to ITU-T Q.1238.2. It is transparent at the CCF/CUSF level.

11.26 USIServiceIndicator

For a definition of this parameter, refer to ITU-T Q.1238.2. It is used as a monitoring criterion at the CCF/CUSF level.

12 Error procedures

This clause defines the error procedures for the CUSF-SCF interface. Error descriptions are provided in Q.1238.1 and the following subclauses provide operation-related error procedures and when relevant, error procedures related to error conditions which are not directly related to the failure of an operation.

12.1 Operation-related error procedures

The following subclauses define the generic error handling for the operation-related error procedures on the CUSF-SCF interface. The errors are defined as operation errors in the ASN.1 operations related description. The TC services which are used for reporting operations errors are described in clause 14.

The following table provides the list of operations which may return each of the errors used on the CUSF-SCF interface.

Table 6/Q.1238.7 – Available errors for each operation

| Errors | SCF → CUSF | | | | | | | | CUSF → SCF | | | |
|---|------------|-------|-----|----|-----|--------|-------|--|------------|-----|----|------|
| | IA | RRBuE | SdC | CA | CtA | RRUTSI | SSTUI | | ARA | ARR | CR | IADP |
| MissingCustomerRecord | | | | | | | | | X | X | X | X |
| MissingParameter | X | X | X | X | X | X | X | | X | X | X | X |
| ParameterOutOfRange | X | X | X | X | X | X | X | | X | X | X | X |
| SystemFailure | X | X | X | X | X | X | X | | X | X | X | X |
| TaskRefused | X | X | X | X | X | X | X | | X | X | X | X |
| UnexpectedComponentSequence | X | X | X | X | X | X | X | | X | X | X | X |
| UnexpectedDataValue | X | X | X | X | X | X | X | | X | X | X | X |
| UnexpectedParameter | X | X | X | X | X | X | X | | X | X | X | X |
| UnknownLegID | | X | | | | | X | | | X | X | |
| <p><i>Operations SCF → CUSF</i></p> <p>IA InitiateAssociation RRBuE RequestReportBCUSMEvent SdC SendComponent CA ContinueAssociation CtA ConnectAssociation RRUTSI RequestReportUTSI SSTUI SendSTUI</p> <p><i>Operations CUSF → SCF</i></p> <p>ARA ActivationReceivedAndAuthorized ARR AssociationReleaseRequested CR ComponentReceived IADP InitialAssociationDP</p> <p>NOTE – If the inconsistency exists, ASN.1 definition takes precedence.</p> | | | | | | | | | | | | |

12.1.1 MissingCustomerRecord

The MissingCustomerRecord error is defined in ITU-T Q.1238.1.

12.1.1.1 Operations CUSF → SCF

This clause describes the procedure when the error for an operation invoked from the CUSF occurs in the SCF.

Relevant operations are described in Table 6.

12.1.1.1.1 Procedures at the invoking entity (CUSF)

a) *Sending Operation*

Precondition: refer to the relevant "Operation procedures CUSF – precondition" clause.
Postcondition: refer to the relevant "Operation procedures CUSF – postcondition" clause.

b) *Receiving Error*

Precondition: refer to the relevant "Operation procedures CUSF – postcondition" clause.
Postcondition: CUSF FSM state a: Idle.

The CUSF continues to handle the association or terminate the association with default procedures (network operator specific).

12.1.1.1.2 Procedures at the responding entity (SCF)

Precondition: refer to the relevant "Operation procedures SCF – precondition" clause.
Postcondition: FSM for CUSF state N1: Idle.

The FSM for CUSF detects that the required Service Logic Program does not exist. This is the same situation as for the SSF-SCF case.

12.1.2 MissingParameter

The MissingParameter error is defined in ITU-T Q.1238.1

12.1.2.1 Operations SCF → CUSF

This clause describes the procedure when the error for an operation invoked from the SCF occurs in the CUSF.

Relevant operations are described in Table 6.

12.1.2.1.1 Procedures at the invoking entity (SCF)

a) *Sending Operation*

Precondition: refer to the relevant "Operation procedures SCF – precondition" clause.
Postcondition: refer to the relevant "Operation procedures SCF – postcondition" clause.

b) *Receiving Error*

Precondition: refer to the relevant "Operation procedures SCF – postcondition" clause.
Postcondition: remain in the same state as the operation was sent.

The Service Logic and maintenance functions are informed. Further treatment of the call unrelated processing is dependent on Service Logic.

12.1.2.1.2 Procedures at the responding entity (CUSF)

Precondition: refer to the relevant "Operation procedures CUSF – precondition" clause.
Postcondition: remain in the same state.

The CUSF FSM detects the error in the received operation.

12.1.2.2 Operations CUSF → SCF

This clause describes the procedure when the error for an operation invoked from the CUSF occurs in the SCF.

Relevant operations are described in Table 6.

12.1.2.2.1 Procedures at the invoking entity (CUSF)

a) Sending Operation

Precondition: refer to the relevant "Operation procedures CUSF – precondition" clause.

Postcondition: refer to the relevant "Operation procedures CUSF – postcondition" clause.

b) Receiving Error

Precondition: refer to the relevant "Operation procedures CUSF – postcondition" clause.

Postcondition: CUSF FSM state a: Idle.

The CUSF terminates the association if necessary. If the supplementary service is already active and ready for responding, the CUSF may maintain the association and continue service processing. The choice between these two options is network operator specific.

12.1.2.2.2 Procedures at the responding entity (SCF)

Precondition: refer to the relevant "Operation procedures SCF – precondition" clause.

Postcondition: FSM for CUSF state N1: Idle.

The FSM for CUSF detects the erroneous situation. The Service Logic and maintenance functions are informed.

12.1.3 ParameterOutOfRange

The ParameterOutOfRange error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.1.4 SystemFailure

The SystemFailure error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.1.5 TaskRefused

The TaskRefused error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.1.6 UnexpectedComponentSequence

The UnexpectedComponentSequence error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.1.7 UnexpectedDataValue

The UnexpectedDataValue error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.1.8 UnexpectedParameter

The UnexpectedParameter error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.1.9 UnknownLegID

The UnknownLegID error is defined in ITU-T Q.1238.1.

This error procedure is the same as the MissingParameter error procedure.

12.2 Entity related error procedures

The following subclauses define the error handling for the entity related errors. Since the error situations are not originated by the reception of an operation, the invoking entity is denoted here as the entity at which the error situation is detected. The responding entity is the entity which receives the error report.

The TCAP services used for reporting errors are described in ITU-T Q.1238.1.

12.2.1 Expiration of T_{CUSF}

12.2.1.1 Error description

This error occurs in the CUSF because of an expiration of an application timer T_{CUSF} .

12.2.1.2 Procedures at the invoking entity (CUSF)

Timeout occurs in CUSF for T_{CUSF} .

Precondition: CUSF FSM state b: Waiting for Instructions.

Postcondition: CUSF FSM state a: Idle.

The CUSF FSM aborts the dialogue and moves to the Idle state, and the CUSF terminates the association if necessary (e.g. default exception handling). The abort is reported to the maintenance functions.0

12.2.1.3 Procedures at the responding entity (SCF)

SCF receives a dialogue abort.

Precondition: Any state.

Postcondition: FSM for CUSF state N1: Idle.

The SCF releases all allocated resources and reports the abort to the maintenance functions.

13 ASN.1 definitions

ASN.1 definitions are available as an electronic attachment to this Recommendation.

14 Service assumed by TCAP

14.1 Normal procedures

14.1.1 CUSF-to-SCF messages

14.1.1.1 CUSF-FSM related messages

A dialogue shall be established when the CUSF-FSM moves from the state **Idle** to the state **Waiting for Instructions**. The relevant INAP operation, which is a DP specific operation or an InitialAssociationDP for TDP-R or an InitiateAssociation operation, shall be transmitted in the same message.

No dialogue shall be established when the CUSF-FSM moves from the state **Idle** and back to the state **Idle** on the detection of TDP-N. The relevant INAP operation, which is a DP specific operation or an InitialAssociationDP for TDP-N, shall be sent with a TC-BEGIN request primitive and the dialogue is locally ended by means of TC-END request primitive with prearranged end.

For all other operations sent from the CUSF-FSM, the dialogue shall be maintained except for the following cases.

When the CUSF sends the last event report operation, the dialogue may be ended from the CUSF by a TC-END request primitive with basic end.

In the case that there is no pending operation and TCAP dialogue is established, TCAP dialogue can be terminated by TC-END primitive with zero component or prearranged end. When the CUSF-FSM makes a non-error case state transition to the state **Idle** and there is no operation to be sent, the dialogue is ended by means of a TC-END request primitive (basic) with zero components, or the dialogue is locally ended by means of a TC-END request primitive with prearranged end. The CUSF can end a dialogue with a TC-END request primitive with zero component or prearranged end depending on that TCAP dialogue is established or not, in the case association release between the user and the network is initiated by any other entity.

When the CUSF has sent the last event report operation, the dialogue may be ended from the SCF by a TC-END request primitive with basic end.

14.1.1.2 CUSME related messages

The dialogue shall be maintained when the ActivityTest Return Result is sent.

14.1.2 SCF-to-CUSF messages

14.1.2.1 SCSM-FSM related messages

No dialogue shall be established when the SCSM-FSM moves from state **Idle** to state **Idle** upon receipt of a DP specific operation or an InitialAssociationDP operation for TDP-N. The operation is received with a TC-BEGIN indication primitive and the dialogue is locally terminated by means of a TC-END request primitive with prearranged end.

A dialogue shall be established when the SCSM-FSM moves from state **Idle** to state **Preparing CUSF Instructions** upon the receipt of a DP specific operation or an InitialAssociationDP operation for TDP-R, or upon the sending of an InitiateAssociation operation.

For subsequent operations sent from the SCSM-FSM, the dialogue shall be maintained except for the following cases, i.e. all other operations are sent after a dialogue was established from the CUSF (the SCF has previously received a TC-BEGIN indication primitive with one of operations for TDP-R).

The dialogue shall no longer be maintained when the prearranged end condition is met in the SCF. When the SCF does not expect any messages other than possibly REJECT or ERROR messages for the operations sent and when the last associated operation timer expires, the dialogue is locally ended by means of a TC-END request primitive with prearranged end.

Alternatively, the sending of operations, leading to the termination of the relationship, by means of a TC-END request primitive (basic end) is possible.

14.1.2.2 SCME-FSM related messages

The operation(s) sent from the SCME-FSM shall be issued according to the following procedure(s):

- The dialogue shall be maintained when the ActivityTest operation is sent.

14.2 Abnormal procedures

The procedures for SCF-CUSF are the same as that for SCF-SSF. Refer to ITU-T Q.1238.2.

14.2.1 Dialogue handling

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.1.1 Dialogue establishment

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.1.2 Dialogue continuation

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.1.3 Dialogue termination

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.1.4 User abort

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.1.5 Provider abort

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.1.6 Mapping to TC dialogue primitives

The CUSF-SCF IN services can be mapped onto TC services. This clause defines the mapping of the CUSF-SCF IN services onto the services of the TC dialogue handling services defined in ITU-T Q.771.

The mapping of the parameters onto the TC-BEGIN primitive is defined in ITU-T Q.1238.1 with the following qualifications:

- The Application Context Name parameter shall take the value of the application-context-name field of the **cs3cusfscfDPSpecificAC** or **cs3cusfscfGenericAC** object if the originating AE is a CUSF, or the **cs3scfcusfDPSpecificAC** or **cs3scfcusfGenericAC** object if the originating AE is an SCF.

14.2.2 Component handling

14.2.2.1 Procedures for INAP operations

Refer to the general descriptions in ITU-T Q.1238.1.

14.2.2.2 Mapping to TC component parameters

The mapping of parameters for the TC component services is defined in ITU-T Q.1238.1 with the following qualifications.

The Timeout Parameter of the TC-INVOKE service is set according to the requirements set out in the SCF-CUSF interface section.

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