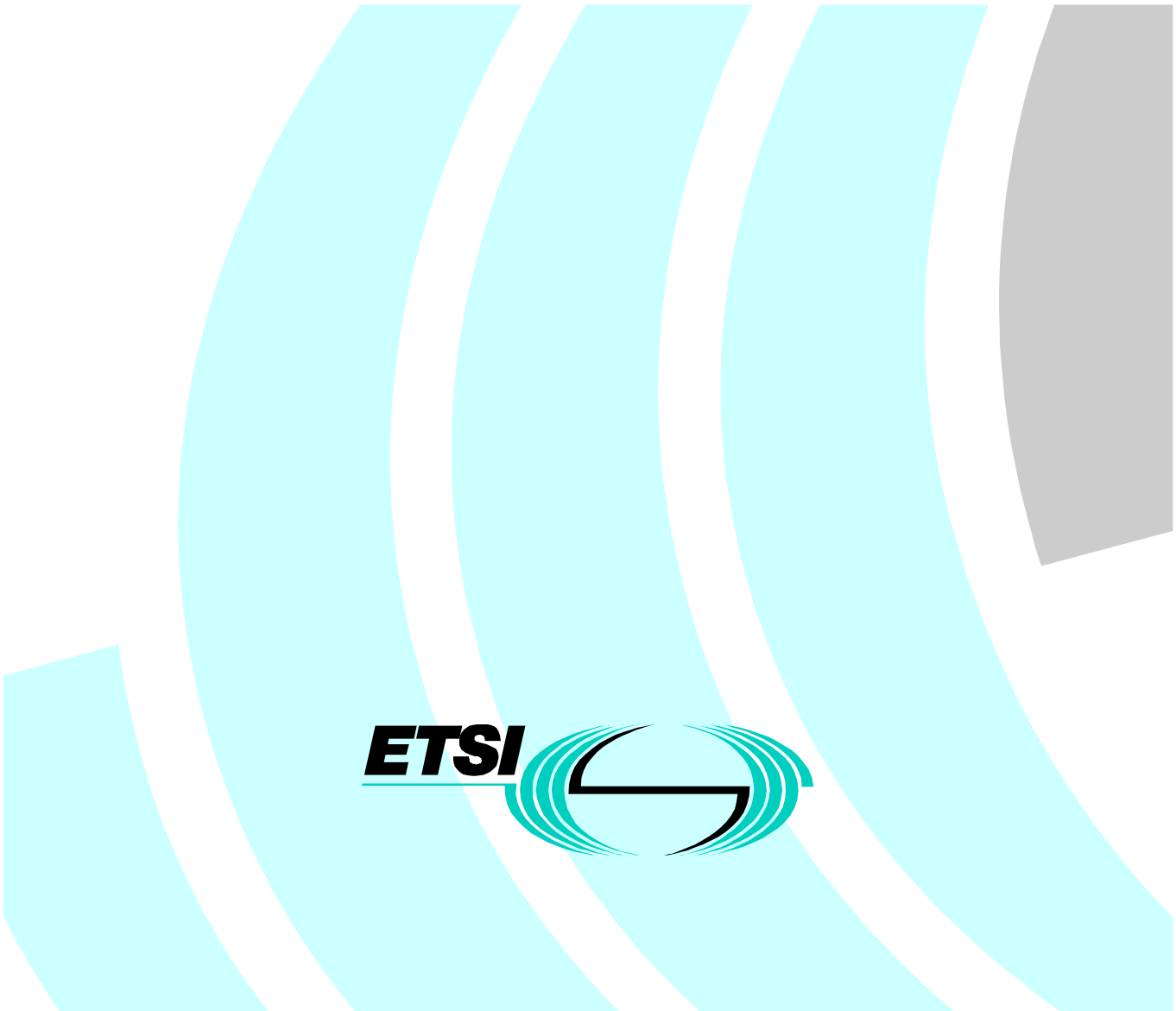
Final draft ETSI EN 301 140-5 V1.1.2 (1999-08)

European Standard (Telecommunications series)

Intelligent Network (IN);
Intelligent Network Application Protocol (INAP);
Capability Set 2 (CS2);
Part 5: Distributed Functional Plane (DFP)

[ITU-T Recommendation Q.1224 (1997) modified]



Reference
DEN/SPS-03038-5 (ak190idc.PDF)

Keywords
IN, CS2, INAP

ETSI

Postal address
F-06921 Sophia Antipolis Cedex - FRANCE

Office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Internet
secretariat@etsi.fr
Individual copies of this ETSI deliverable
can be downloaded from
http://www.etsi.org
If you find errors in the present document, send your
comment to: editor@etsi.fr

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://www.etsi.org/ipr).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Signalling Protocols and Switching (SPS), and is now submitted for the Voting phase of the ETSI standards Two-step Approval Procedure.

The present document is based on ITU-T Recommendation Q.1224 [6]. It provides major modifications and further requirements to this base document.

The present document is part 5 of a multi-part standard covering Intelligent Network (IN); Intelligent Network Application Protocol (INAP); Capability Set 2 (CS2) as described below:

Part 1: "Protocol specification";

Part 2: "Protocol Implementation Conformance Statement (PICS) proforma specification";

Part 3: "Test Suite Structure and Test Purposes (TSS&TP)";

Part 4: "Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma";

Part 5: "Distributed Functional Plane (DFP)".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document is based on ITU-T Recommendation Q.1224 [6]. It provides major modifications and further requirements to this base document.

The scope of the IN Distributed Functional Plane (DFP) architecture for IN capability set 2 (CS2) is driven by the service requirements of desired IN CS2 services, and constrained by the capabilities of the embedded base of evolvable network technology. The scope of functionality required to support desired IN CS2 services includes functionality to provide:

- end user access to call / service processing;
- service invocation and control;
- end user interaction with service control;
- service management;
- Call Party Handling;
- internetworking;
- security;
- Out-Channel Call Related User Interaction;
- Out-Channel Call Unrelated User Interaction;
- wireless Access; and
- Feature Interactions.

The scope of each of these aspects is addressed in clause 2 of ITU-T Recommendation Q.1224 [6] and is endorsed by the present document.

The present document follows the same document structure as ITU-T Recommendation Q.1224 [6] for clause 4 onwards and refers to text in ITU-T Recommendation Q.1224 [6] when there is no difference in the present document compared to ITU-T Recommendation Q.1224 [6]. If there are changes the related text is included in the relevant clause.

Clause 1 (General), clause 2 (Scope of IN distributed functional plane for capability set 2) and clause 3 (Distributed functional model for IN CS2) in ITU-T Recommendation Q.1224 [6] are endorsed by the present document.

The following capabilities supported in ITU-T Recommendation Q.1224 [6] are excluded from the present document:

- The Hybrid Approach for the Connection View State;
- Trigger Detection Point - Notification for the SSF/CCF-SCF interface;
- DP specific INAP operations
  Only DP generic INAP operations are supported by ETSI Core INAP CS2 which means that following DP specific operations supported in ITU-T IN CS2 are not part of ETSI IN CS2: AnalysedInformation, AnalyseInformation, AuthorizeTermination, CollectedInformation, FacilitySelectedAndAvailable, OAbandon, OAnswer, OCalledPartyBusy, ODisconnect, OMidCall, ONoAnswer, OriginationAttempt, OriginationAttemptAuthorized, OSuspended, RouteSelectFailure, SelectFacility, SelectRoute, TAnswer, TBusy, TDisconnect, TMidCall, TNoAnswer, TerminationAttempt, TermAttemptAuthorized and Tsuspended.

Supported information flows are in subclause 4.1.5 of EN 301 140-1 [10].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] EN 300 374-1: "Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: Protocol specification".

[2] EN 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".

[3] ITU-T Recommendation Q.762: "Signalling System No.7; ISDN user part general functions of messages and signals".

[4] ITU-T Recommendation Q.763: "Signalling System No. 7; ISDN user part formats and codes".

[5] ITU-T Recommendation Q.932: "Digital Subscriber Signalling System No. 1 (DSS 1); Generic procedures for the control of ISDN supplementary services".

[6] ITU-T Recommendation Q.1224: "Distributed functional plane for Intelligent Network Capability Set 2".

[7] ITU-T Recommendation Q.1228: "Interface ITU-T Recommendation for intelligent network CS2".

[8] ITU-T Recommendation Q.1290: "Glossary of terms used in the definition of intelligent networks".

[9] ITU-T Recommendation Q.1218: "Interface Recommendation for intelligent network CS-1".

[10] EN 301 140-1: "Intelligent Network (IN); Intelligent Network Application Protocol (INAP); Capability Set 2 (CS2); Part 1: Protocol specification".

[11] ITU-T Recommendation Q.1204: "Intelligent network distributed functional plane architecture".

[12] ITU-T Recommendation Q.1214: "Distributed functional plane for intelligent network CS1".

[13] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[14] ES 201 296: "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP); Signalling aspects of charging".

3 Abbreviations

For the purposes of the present document, the abbreviations given in EN 301 140-1 [10] and the following apply:

BRI	Basic Rate Interface (2 x 64 kbit/s + 1 x 16 kbit/s)
CP	Connection Point
CPG	Call Progress message
DFP	Distributed Functional Plane
IF	Information Flow
SIB	Service Independent Building Box
SPID	Service Profile IDentifier

4 SSF/CCF model

4.1 General

Text in subclause 4.1 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.2 Basic call manager (BCM)

Text in subclause 4.2 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.2.1 BCSM

Text in subclause 4.2.1 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.2.2 CS2 BCSM description

The BCSM for IN CS2 described in this subclause is based on the overall BCSM in annex A of ITU-T Recommendation Q.1204 [11] and ITU-T Recommendation Q.1214 [12], refined as applicable to IN CS2.

It reflects the functional separation between the originating and terminating portions of calls as illustrated in figures 4.1 and 4.2. These figures show an originating half BCSM and a terminating half BCSM, each of which is managed by a functionally separate BCM in the SSF/CCF. The description is a starting point to identify the aspects of the BCSM that are visible to IN service logic instances, and the nature of the information flows between the SSF/CCF and SCF (see clause 12).

In the following descriptions, the PICs are related at a high level to EN 300 403-1 [2] ISDN call states. This is not intended to be a detailed formal definition of the relation between the PICs and EN 300 403-1 [2] ISDN call states, but is intended as a point of reference to use in understanding the PICs. In particular, there are a number of possible ways in which the EN 300 403-1 [2] call states may be traversed in certain situations which are not considered below. To enable independence between services offered during one call session when the PICs may be traversed several times, it is necessary - at each PIC - to maintain available a specific set of data until the calling (controlling) user releases and to ensure that software resources are returned to a coherent status when call processing passes through the PICs.

For each PIC, an initial list of BCSM information that must be maintained, if available, is given. Information that is available at all PICs is given at the beginning of the O- and T-BCSM descriptions.

The information that is sent to the SCF at a given trigger detection point is a subset of the information described here. Other information may be available at a given PIC that is not used by processing at the PIC or is only used by underlying call processing.

In order to maintain uniqueness of DP names between the originating and terminating half BCSMs, "O" and "T" is prefixed to certain originating and terminating DP names, respectively.

For ease of reference, the DPs associated with the BCSM transition implied by each entry and exit event for each PIC are listed along with the PIC descriptions.

The semantics for Abandon and Disconnect DP needs further clarification. Some misalignments inside Part 1 and between Part 1 and Part 5 have been detected. It is also allowed to report Disconnect DP during the WfEoU(WFI), and WfEoTC(WFI) user interactions states.

4.2.2.1 Originating BCSM for IN CS2

The originating half of the BCSM corresponds to that portion of the BCSM associated with the originating party (see figure 4.1).

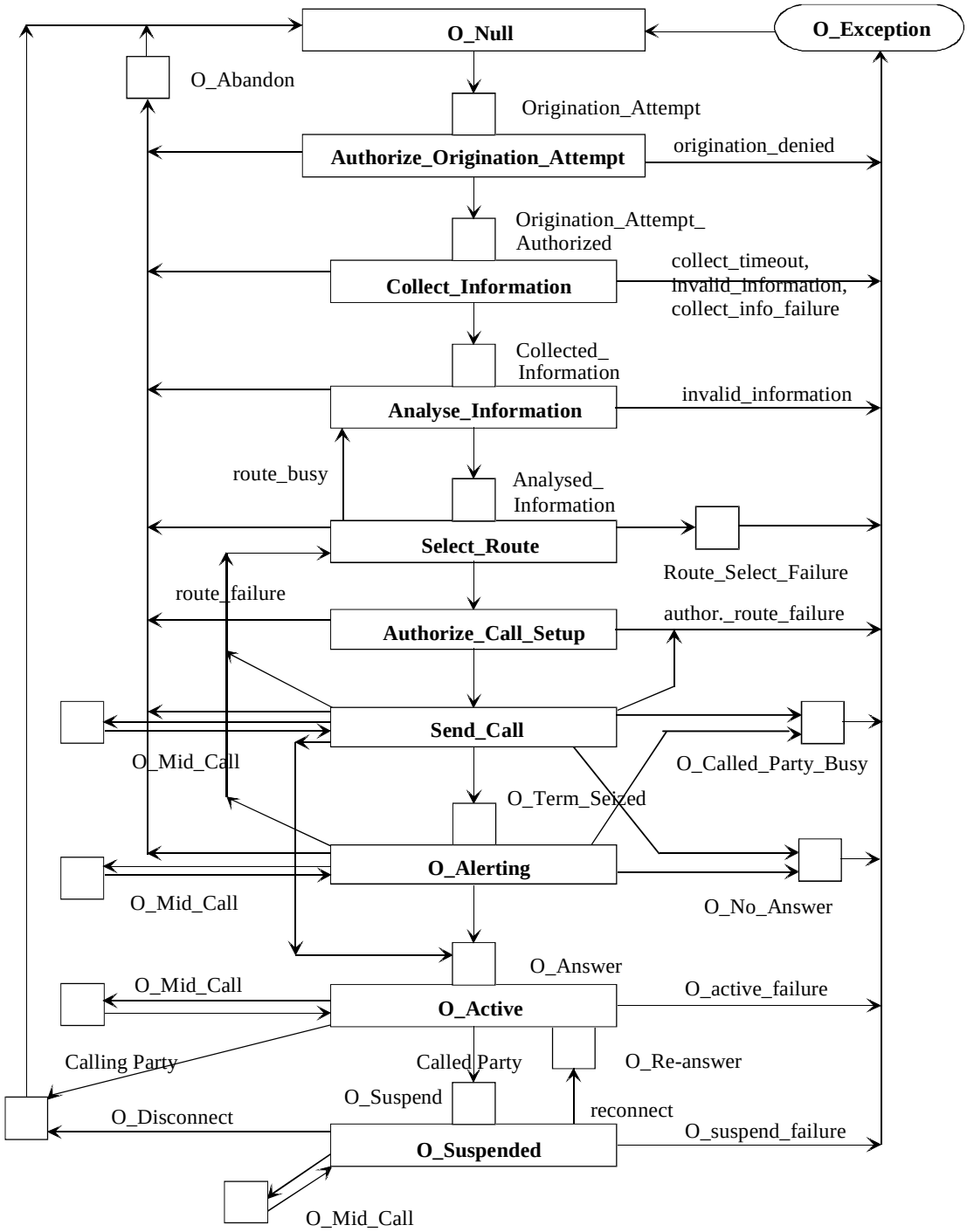


Figure 4.1: Originating BCSM for CS2

The following information is available at all PICs in the O-BCSM:

- Calling Party Category - see ITU-T Recommendation Q.762 [3] Calling Party's Category signalling information.
- SRF/SSF capabilities - see ITU-T Recommendation Q.1290 [8]. Used to decide if an assist of hand-off procedure is to be used.
- Call Gapping Encountered - see ITU-T Recommendation Q.1290 [8].
- Terminal Type - see ITU-T Recommendation Q.1290 [8]. The SCF uses this to determine the most appropriate form of user-interaction to use (e.g. in-band announcements). This information is only available at originating or terminating local exchanges.
- Location Number - see ITU-T Recommendation Q.762 [3] Location Number signalling information. Used if the calling party is a mobile subscriber.
- ISDN Access Related Information: - See ITU-T Recommendation Q.762 [3] Access Transport Parameter.
- Original Called Party ID - see ITU-T Recommendation Q.762 [3] Original Called Party Number element. This ID refers to the case where the call is diverted.
- Redirecting Party ID - see ITU-T Recommendation Q.762 [3] Redirecting Party ID element. This ID refers to the case where the call is diverted.
- Redirection Information - see ITU-T Recommendation Q.762 [3] Redirection Information element. This information refers to the case where the call is diverted.
- Additional Calling Party Number - see ITU-T Recommendation Q.762 [3] Generic Number element.
- Forward GVNS - see ITU-T Recommendation Q.762 [3] Forward GVNS element.
- The description for each of the PICs in the originating half of the BCSM are described below:

NOTE: See BCSM Indications of subclause 4.2.4 for more information concerning PICs.

4.2.2.1.1 O_Null

Entry event: Disconnect and clearing of a previous call (DPs: O_Disconnect and O_Abandon), or default handling of exceptions by SSF/CCF completed.

Functions: Interface (line / trunk) is idled (no call exists, no call reference exists, etc.). Supervision is being provided.

Information available: After detecting the Origination Attempt event, it is assumed that the SSF/CCF has the following information available associated with the originating call portion, with restrictions as noted. If the SSF/CCF determines that the origination is denied, the cause of the failed authorization is also known.

- Bearer Capability - see ITU-T Recommendation Q.762 [3] User Service Information and EN 300 403-1 [2] Bearer Capability information element.
- Calling Party Number - see ITU-T Recommendation Q.762 [3] Calling Party Number signalling information. This information is available at the SSF/CCF for a non-ISDN line and may be available for SS7 trunks, but is not available from trunks supported by conventional signalling or private-facility trunks. For a DSS 1 interface, this is determined by the information provided in the SETUP message or by the default number assigned to the caller (see ISDN SETUP information below).
- SRF Available - see ITU-T Recommendation Q.1290 [8].
- Service Profile Identifier (SPID) - see ITU-T Recommendation Q.932 [5], annex A. This information may be available at the SSF/CCF if the calling party is served by a BRI interface on this SSF/CCF.
- Called Party Number - see ITU-T Recommendation Q.762 [3] Called party number signalling information. Used to identify the called party in the forward direction. Available only for trunks or ISDN lines.
- Transit network selection - see ITU-T Recommendation Q.763 [4] Transit network selection parameter. This parameter, if present, identifies the Carrier Identification Code and the Circuit Code.

- Class of Service - see ITU-T Recommendation Q.1290 [8].
- Calling Party Business Group ID (BGID) - see ITU-T Recommendation Q.1290 [8] Business Group ID. This information is available for a non-ISDN line, ISDN interface, private-facility trunk group, or possibly an SS7 trunk when the caller is a member of a Business Group.
- Calling Facility Group - see ITU-T Recommendation Q.1290 [8]. Available on conventional or SS7 trunks.
- Calling Facility Group Member - see ITU-T Recommendation Q.1290 [8]. Available on conventional or SS7 trunks.
- Travelling Class Mark - see ITU-T Recommendation Q.1290 [8].
- Feature Code - see ITU-T Recommendation Q.762 [3] Feature Code Signalling Information where this parameter is defined for national use only. Available, if used, for a party served by an ISDN interface using en bloc sending or for an SS7 trunk.
- Access Code - see ITU-T Recommendation Q.1290 [8]. Available, if used, for a party served by an ISDN interface using en bloc sending.
- Operator Services Information - see ITU-T Recommendation Q.1290 [8]. This information element is not included in a SETUP message containing the keypad information element.
- ISDN SETUP feature-related information - see EN 300 403-1 [2]. The SSF/CCF receives a SETUP message from a DSS 1 interface and this SETUP message can also contain the following information:
  - Progress Indicator - see EN 300 403-1 [2] Progress indicator information element.
  - Keypad Facility - see EN 300 403-1 [2] Keypad facility information element. This information element is not expected in a SETUP message also containing the Called party number, Called party number subaddress, Transit network selection, or Operator services information elements.
  - Feature activation - see ITU-T Recommendation Q.932 [5] Feature activation information element.
  - Calling party number - see EN 300 403-1 [2] Calling party number information element.

    The Called party number information element is sent when en bloc sending is used and the Keypad information element is not present. When the type of number and numbering plan identification field within the Called party number information element is set to "unknown," the SSF/CCF treats the string as if it has been received within a Keypad information element. In this case, it is not expected to be sent with the transit network selection or Operator services information elements.
  - Facility Information - see EN 300 403-1 [2] Facility information element. This information element may identify USI Information or Facility Information.
  - Other information, as defined by ITU-T Recommendation Q.932 [5], Generic Procedures for the Control of ISDN Supplementary Services, can be included. Some of this information may be of interest to the SCF.
- ISDN User Part IAM feature related information. The IAM can also contain the following information (see ITU-T Recommendations Q.762 [3] and/or Q.763 [4]):
  - Nature of connection indicators - see ITU-T Recommendation Q.763 [4] Nature of Connection Indicators parameter.
  - Forward call indicators - see ITU-T Recommendation Q.763 [4] Forward Call Indicators parameter. The caller's access is identified as ISDN or non-ISDN, and an indication is given of whether an end-to-end SS7 supported connection is required.
  - User service information - see ITU-T Recommendation Q.762 [3]. User Service Information parameter. For the purposes of IN CS2, this parameter identifies the call as circuit-mode / speech, circuit-mode / 3,1 kHz audio, circuit-mode / unrestricted digital information (64 kbps), or circuit-mode / restricted digital information.
  - Generic Number - see ITU-T Recommendation Q.762 [3] Generic number parameter. More than one generic number parameter may be present within a given IAM.

- Generic name - see ITU-T Recommendation Q.1290 [8].
- Carrier selection - see ITU-T Recommendation Q.1290 [8].
- Generic digits - see ITU-T Recommendation Q.762 [3]. May contain a travelling class mark (network operator specific).
- Other parameters may be included in the IAM. These parameters may be included because of features provided by other switches in the connection (e.g. information relating to the call being forwarded).

- Any information relating to switch-based features that have already been invoked for the call will also be available.

Exit event:

- Indication of desire to place outgoing call (e.g. off-hook, EN 300 403-1 [2] SETUP message, ISDN-UP IAM message) (DP: Origination_Attempt).
- The following exception exit events are applicable to the O_Null PIC. For this PIC, if the call encounters one of these exceptions during O_Null PIC processing, the exception event is not visible because there is no corresponding DP.
  - The O_Abandon occurs when the calling party disconnects. For example, this event can result from one of the following:
    - the SSF/CCF receives an on-hook indication from a caller served by a non-ISDN line, following switchhook flash timing;
    - the SSF/CCF receives a call clearing message from a caller served by an ISDN interface;
    - the SSF/CCF receives a disconnect indication from a conventional trunk or private facility trunk;
    - SSF receives a Release Message from an SS7 trunk.

Corresponding EN 300 403-1 [2] call state: O_Null

4.2.2.1.2 Authorize_Origination_Attempt

Entry event: An indication is available that the originating terminal needs to be authorized. (DP: Origination_Attempt).

Functions:

- The originating terminal rights should be checked using the calling party's identity and service profile. The authority / ability of the party to place the call with given properties (e.g. bearer capability, line restrictions) is verified. The types of authorization to be performed may vary for different types of originating resources (e.g. for lines vs. trunks).
- Other features which might be required during this PIC are not described in the IN CS2 BSCM.

Information available: After detecting the Origination_Attempt_Authorized event, it is assumed that the SSP has the same information available associated with the originating call portion as it did after detecting the Origination_Attempt event in the O_Null PIC.

If the SSP determines that the origination is denied, the cause of the failed authorization is also known.

Exit event:

- An indication is received that the authorization is successful. The O_BCSM moves to the Collect_Information PIC (DP: Origination_Attempt_Authorized).
- A disconnection indication is received from the originating party (DP: O_Abandon).
- An indication is received that the call origination is denied. The O_BCSM moves to the O_Exception PIC.

4.2.2.1.3 Collect_Information

Entry event: Authority / ability to place outgoing call verified. (DP: Origination_Attempt_Authorized).

Functions:

- Initial information package / dialling string (e.g. service codes, prefixes, dialled address digits) being collected from originating party. Information being examined according to dialling plan to determine end of collection. No further action may be required if an en bloc signalling method is in use (e.g. an ISDN user using en bloc signalling, an incoming SS7 trunk).

- The SSF/CCF shall be able to support subsequent digit collection according to trigger criteria assigned before sending the query. For example if a feature code (e.g. *64) is entered, the SSF/CCF may:

    - collect digits according to the normal dialling plan, or

    - collect a variable number of digits.

Information available: After the SSF/CCF determines that information collection is complete, it is assumed that the SSF/CCF has the following information available associated with the originating call portion:

- Calling Party Number, Calling Party BGID, Class of Service, Bearer Capability, Calling Facility Group, Calling Facility Group Member, Service Profile Identifier, other feature-related information, Facility Information. This information is available for each access type under the conditions defined in the O_Null PIC.

- Collected Information - As described below.

From a non-ISDN line or DSS 1 interface, the collected information consists of one or more of the following:

- Access Codes within a Customized Dialling Plan (CDP) - see ITU-T Recommendation Q.1290 [8].

  The Customized Dialling Plan (CDP) in force may specify that after a given access code is dialled, more digits are to be collected according to the "normal dialling plan," i.e. the dialling plan in force. In this case, Access Code and Collected Address Information are known. If the CDP in force specifies that after a given access code is dialled, a variable number of digits are to be collected, then Access Code and Collected Digits are known.

- Feature Code - see ITU-T Recommendation Q.762 [3] Feature Code Signalling Information where this parameter is defined for national use only.

  If the numbering plan in force specifies that after a given feature code is dialled, more digits are to be collected according to the "normal dialling plan", then Feature Code and Collected Address Information are known. If the dialling plan in force specifies that after a given feature code is dialled, a variable number of digits are to be collected, then Feature Code and Collected Digits are known. The service associated with the feature code is dependent upon the users service profile.

- Facility Code - see ITU-T Recommendation Q.1290 [8]. This information may be provided if and when facility selective service signalling is supported.

- Feature Activation - see ITU-T Recommendation Q.932 [5] Feature Activation information element. If the CDP in force specifies that after a given feature activator is received, more digits are to be collected according to the numbering plan, then Feature Activation Indicator and Collected Address Information are known. If the CDP in force specifies that after a given feature activator is received, a variable number of digits are to be collected, then Feature Activation Indicator and Collected Digits are known.

- Prefix - see ITU-T Recommendation Q.1290 [8].

- Carrier Access Code / Carrier Identification Code - see ITU-T Recommendation Q.1290 [8]. The caller may dial a Carrier Access Code (CAC) (e.g. a 10XXX or 101XXXX for use on this call). When the caller is served by an ISDN interface, a Carrier Identification Code, i.e. XXX or XXXX, may be received by the SSF/CCF within the transit network selection information element of the ISDN SETUP message.

- Collected Address Information - see ITU-T Recommendation Q.1290 [8]. Available as per the numbering plan.

- Numbering Plan Indicator - see ITU-T Recommendation Q.762 [3] Numbering Plan Indicator signalling information.

- Collected Digits - see ITU-T Recommendation Q.1290 [8]. The numbering plan in force may specify that after a given Feature Activation, Feature Code, or Access Code within a CDP is dialled, a variable number of digits are to be collected using normal inter-digit timing. In this case, these collected digits are also known at this time.

From a conventional trunk interface, the Collected Information consists of one or more of the following:

- Collected Address Information - as defined above for non-ISDN line or DSS 1 interface.

- Carrier Identification Code - see ITU-T Recommendation Q.1290 [8]. This is known if MF signalling is used on the originating trunk (network operator specific).

- Numbering Plan Indicator - see ITU-T Recommendation Q.762 [3] Numbering Plan Indicator signalling information. The address received is expected to conform to ITU-T Recommendation E.164 [13].

- Prefix - as defined above for non-ISDN line or DSS 1 interface.

- Carrier Selection - see ITU-T Recommendation Q.1290 [8]. This information is only provided when MF signalling is used on the originating trunk (network operator specific).

- Originating Line Information - see ITU-T Recommendation Q.1290 [8]. This information is only known when MF signalling is used on the originating trunk (network operator specific). In this case, the Originating Line Information is sent during the second stage of overlap out pulsing.

From an SS7 trunk interface, the Collected Information consists of the information provided in the ISDN User Part called party number and transit network selection parameters, and possibly a Travelling Class Mark and other feature-related information as described above for contents of the ISDN User Part IAM feature related information.

From a private-facility trunk, the collected information consists of one or more of the following:

- Access Code within a CDP - as defined above for a non-ISDN line;

- Feature Code - as defined above for a non-ISDN line;

- Facility Code - as defined above for a non-ISDN line;

- Collected Address Information - as defined above for a non-ISDN line;

- Numbering Plan Indicator - as defined above for a non-ISDN line;

- Prefix - as defined above for a non-ISDN line;

- Carrier Access Code - as defined above for a non-ISDN line;

- Travelling Class Mark - if provided in the generic digits parameter of the IAM (see ITU-T Recommendation Q.1290 [8]);

- Facility Restriction Level - see ITU-T Recommendation Q.1290 [8].

Exit events:

- Availability of complete initial information package / dialling string from originating party. (This event may have already occurred in the case of en bloc signalling, in which case the waiting duration in this PIC is zero.) (DP: Collected_Info).

- The following exception exit events are applicable to this PIC: CollectTimeout, CollectInfoFailure, InvalidInformation and O_Abandon.

    - The CollectTimeout event is detected when enough information to process the call was not received by the SSF/CCF before a normal interdigit timer expires. For an SS7 trunk, this event corresponds to the IAM not containing the information necessary to process the call. In this case there may be no timing involved (timing may be involved for ISUP overlap sending).

    - The CollectInfoFailure event is detected when the SSF/CCF is unable to perform the information collection due to a lack of switch resources (e.g. no digit receivers are available).

- The Invalidinformation event occurs when the information received from the caller is not valid, for instance the information received violates the dialling plan in force.

- O_Abandon event, as described in the O_Null PIC. In this case, the event is visible because there is a corresponding DP.

Comment: Some digit analysis is required to determine the end of dialling. However, it is assumed that this analysis may be modelled as separable from the rest of digit analysis, which occurs in the Analyse_Information PIC. There is no intention to specify an implementation. However, a switch should externally present the separable view described for closed numbering plans (see note 1).

In the case of ISDN en bloc sending, the receipt of a SETUP message detected at the Origination_Attempt_Authorized DP causes the BCSM to pass through the Collect_Information PIC to the Collected_Information DP, without further processing in the Authorized_Origination_Attempt PIC. Note that the BCSM transitions to Collected_Information DP when the initial information package / dialling string is received from the calling party - this occurs when enough information is received to proceed with call processing (e.g. as in the case of ISDN overlap sending of MF out pulsing). Specifically, for the digit by digit collection case, if the Collected_Information DP is armed as a Trigger detection Point-Request (TDP-R), the SSF sends an initialling DP request (i.e. Initial DP information flow) to the SCF when enough is received to determine if the TDP criteria is met. It suspends BCSM processing but will collect further digits. It is network operator specific to determine when complete information is available (see note 2).

NOTE 1: This separable view is provided by supporting distinct DPs. The Collected_Information DP is used after digit collection and the Analysed_Information DP is used after the rest of the digit analysis.

NOTE 2: In some networks, it may be not possible for the CCF/SSF to determine when the called number information is complete. Therefore, TDP criteria for Collected_Information DP may be met in such networks before the called number information is complete.

Corresponding EN 300 403-1 [2] call state: 1. Call Initiated and (optionally) 2. Overlap Sending.

4.2.2.1.4 Analyse_Information

Entry event: Availability of complete initial information package / dialling string from originating party (DP: collected_Information) or route busy event reported from the Select Route PIC.

Function: Information being analysed and/or translated according to dialling plan to determine routing address and call type (e.g. local exchange call, transit exchange call, international exchange call).

The following provides details as to when the next Route should be tried under each condition.

Parameters Received:	DestinationRoutingAddress
Result:	Busy or No Answer
Processing Order:	CDPN
No alternative route can be selected based on a second CDPN.	
Parameters Received:	RouteList, DestinationRoutingAddress
Result:	No route out of local switch (busy)
Processing Order:	Route1, CDPN
	Route2, CDPN
	Route3, CDPN
Parameters Received:	RouteList, DestinationRoutingAddress
Result:	Route busy is found to be at a switch other than local switch
Procesing Order:	Route1, CDPN

No other routes need be tried since the local route is successful, but a busy condition was encountered elsewhere.

Parameters Received: RouteList, DestinationRoutingAddress

Result: No answer received

Processing Order: Route1, CDPN

No other routes need be tried since the route is successful, but a no answer condition was encountered.

Only after the appropriate Routes have been tried will the call move onto the O_Called_Party_Busy DP, O_No_Answer DP, or Route_Select_Failure DP as appropriate.

One of the results of processing in this PIC is determination of routing address:

i) called party number only (called party number is served by the SSF);

ii) called party number and route index, where the route index is a pointer to a trunk group to route an out going call attempt on (called party number is served by another SSF);

iii) called party number and route index, where the route index is a pointer to a list of trunk groups to route an outgoing call attempt on (called party number is served by another SSF).

Information available: After the SSF/CCF determines the information has been analysed, it is assumed that the SSF/CCF has the following information available associated with the originating call portion:

- Calling Party Number, Calling Party BGID, Class of Service, Bearer Capability, Calling Facility Group, Calling Facility Group Member, Service Profile Identifier, Facility Information and other feature-related information This information is available for each access type under the conditions defined in the O_Null PIC.

- Analysis Results (of the Collected Information) - as described below.

From a non-ISDN line or DSS 1 interface, this consists of one or more of the following:

- Called Party Number - as per dialling plan.

- Numbering Plan Indicator - see ITU-T Recommendation Q.762 [3] Numbering Plan Indicator signalling information.

- Type Of Call - see ITU-T Recommendation Q.1290 [8].

- Carrier - see ITU-T Recommendation Q.1290 [8].

- Carrier Identification Code - see ITU-T Recommendation Q.1290 [8]. Available for Internetwork carrier calls.

- Carrier Selection - see ITU-T Recommendation Q.1290 [8]. Available for Inter Serving Area ID carrier calls. See ITU-T Recommendation Q.1218 [9].

- Route List - see ITU-T Recommendation Q.1290 [8].

- Collected Information - Access Code within a CDP, Feature Code, Feature Activation, Prefix, Carrier Access Code / Carrier Identification Code, Collected Address Information / Digits -as described under the Collect_Information PIC.

From a conventional or SS7 trunk interface, this consists of one or more of the following:

- Called Party Number and Numbering Plan Indicator (as defined above for non-ISDN line or DSS 1 interface).

- Carrier Identification - available for Inter Serving Area ID carrier calls. See ITU-T Recommendation Q.1218 [9].

- Carrier Selection - see ITU-T Recommendation Q.1290 [8]. Available for Inter Serving Area ID carrier calls. See ITU-T Recommendation Q.1218 [9].

- Originating Line Information - see ITU-T Recommendation Q.1290 [8]. Available for Inter Serving Area ID carrier calls. See ITU-T Recommendation Q.1218 [9].

- Route Index - see ITU-T Recommendation Q.1290 [8]. Available if this call does not terminate on this SSF/CCF.
- Collected Information - Collected Address Information, Prefix, Carrier Identification Code, Feature Code, Facility Code - see description under the Collect_Information PIC.

From a private-facility trunk, this consists of one or more of the following, depending on the type of private-facility trunk:

- Called Party Number and Numbering Plan Indicator (as defined above).
- Type Of Call (as defined above).
- Carrier - see ITU-T Recommendation Q.1290 [8]. Private network / facility, intra-serving-area, or a specific Inter Serving Area ID or international). See ITU-T Recommendation Q.1218 [9].
- Carrier Identification Code - see ITU-T Recommendation Q.1290 [8]. Available for internetwork carrier calls.
- Carrier Selection - see ITU-T Recommendation Q.1290 [8]. Available for Inter Serving Area ID carrier calls. See ITU-T Recommendation Q.1218 [9].
- Travelling Class Mark - see ITU-T Recommendation Q.1290 [8]. Available if received on the facility.
- Route List - see ITU-T Recommendation Q.1290 [8].
- Facility Restriction Level - as described under the Collected_Information PIC.
- Collected Information - Collected Address Information / Digits, Access Code within a Customer Dialling Plan, Feature Code, Carrier Access Code, Prefix - see description under the Collected_Information PIC.

Exit events:

- Availability of routeing address an nature of address. (DP: Analysed_Information).
- The following exception exit events are applicable to this PIC: InvalidInformation and O_Abandon:
  - The InvalidInformation event Occurs when the information received from the caller is not valid, for instance the information received violates the dialling plan in use.
  - The O_Abandon event, as described in the O_Null PIC. In this case, the event is visible because there is a corresponding DP.

Comments: Note that routeing address does not necessarily mean that the final physical route has been determined (e.g. route list has not been searched, hunt groups have not yet been searched, directory number has not yet been translated to physical port address), though this may be the case (e.g. when routeing to a specific private facility).

Corresponding EN 300 403-1 [2] call state: Not applicable.

4.2.2.1.5 Select Route

Entry events: Availability of routeing address and call type. (DP: Analysed_Information) or route busy event reported from the Send_Call or O_Alerting PICs.

Functions:

- Routeing address and call type are being interpreted. The next route is being selected. This may involve sequentially searching a route list, translating a directory number into physical port address, etc. The individual destination resource out of a resource group (e.g. a multi-line hunt group, a trunk group) is not selected. In some cases (e.g. an analogue line interface), a single resource (not a group) is selected.
- The individual destination resource of a resource group (e.g. a specific line if a multiline hunt group) is not selected.
- When the entry event is the route failure event from the Send_Call PIC (see below), the SSF/CCF must first check the Route Failure Condition 1, Route Failure Condition 2, or Route Failure Condition 3 as defined under

the Send_Call PIC exit events. If these conditions are true, then the call shall proceed to the Analyse Information PIC.

If these three conditions are not met, then depending on the location in the network where the route is busy, the action is one of the following:

- If the trunk group selected for the call is busy at this switch, the SSF/CCF attempts to route the call on the next trunk group that has been specified for the call (when a route list is being searched or alternate routes are specified by the SCF). Call processing moves to the Analyse_Information PIC when one of two conditions occurs: all private-facility trunk groups have been tried and routeing over a public facility is allowed, or routeing to a particular intra or internetwork carrier has been tried and an alternate carrier is allowed.

- If all of the trunk groups (private and public) been tried and no route is available, the Route_Select_Failure event is detected.

- If route busy is detected at another switch, an indication of this condition may be received via SS7 signalling. In this case, a Route_Select_Failure event is detected.

Information available: After the SSF/CCF determines the route has been selected, it is assumed the SSF/CCF has the following information available with restrictions as noted:

- Calling Party Number, Calling Party Business Group ID, Class of Service, Bearer Capability, Calling Facility Group, Calling Facility Group Member, Service Profile Identifier, Facility Information other feature-related information - This information is available for each access type under the conditions defined in the O_Null PIC.

- Analysis Results - See description in the Analyse_Information PIC.

- Routing Information - When more than one route has been specified for the call (either by the SCF or as part of the information stored at the SSF/CCF), the SSF/CCF remembers what routes have been tried for this call and which route to select next. If the call is to an Inter Serving Area ID carrier, Routing Information includes Circuit Code information. See *ITU-T Recommendation Q.*1228 [7].

Exit events:

- Route Selected event.

- Unable to select a route (e.g. unable to determine a correct route, no more routes on route list) or indication from the terminating half BCSM that call cannot be presented to the terminating party (e.g. network congestion). (DP: Route_Select_Failure).

- The route busy event leading to the Analyse_Information PIC as described above, or the following conditions are met:

  a) unable to select a route (e.g. unable to determine a correct route, no more routes on route list) or indication from the terminating half BCSM that call cannot be presented to the terminating party (e.g. network congestion);

  b) the route was determined by switch translations at the Analyse_Information PIC;

- Route busy is a non-IN transition which is part of a basic call.

- Originating party abandons call (DP: Abandon).

4.2.2.1.6 Authorize_Call_Setup

Entry events: Route Selected event.

Function: The authority of the calling party to place this particular call is verified.

Information available: After the SSF/CCF determines the call setup has been authorized, it is assumed the SSF/CCF has the following information available with restrictions as noted:

- Calling Party Number, Calling Party Business Group ID, Class of Service, Bearer Capability, Calling Facility Group, Calling Facility Group Member, Service Profile Identifier, Facility Information other feature-related information - This information is available for each access type under the conditions defined in the O_Null PIC.
- Analysis Results - see description in the Analyse_Information PIC.
- Routing Information - see description in the Select_Route PIC.
- Facility Restriction Level - as described under the Collect_Information PIC.

Exit events:

- Call Setup Authorized event. The Call Setup Authorized event occurs when the authority to place the call is verified. For an SS7-supported trunk interface, if the received IAM indicates that a continuity check is being performed on the call connection and the call terminates to a non-ISDN line or ISDN interface, the Call Setup Authorized event occurs when an ISDN-UP Continuity Message (COT) with a successful indication is received.
- Originating party abandons call (DP: O_Abandon).
- The Authorization Failure event occurs when the authority to place the call is denied (e.g. business group restriction mismatch, toll restricted calling line). For an SS7-supported trunk interface, the Authorization Failure event occurs when the continuity check procedure results in failure. This event causes a BCSM transition to O_Exception.

4.2.2.1.7 Send_Call

Entry events: Call Setup Authorized event.

Functions: The SSF/CCF sends an indication of the desire to set up a call to the specified Called Party ID to the terminating call portion. The information that may be passed to the terminating call portion is: Calling Party ID; Calling Party BGID; Calling Party Category (determined by the Class of Service information or ISDN-UP originating line information parameter); Bearer Capability; Called Party ID; Calling Party Subaddress; Called Party Subaddress; Carrier; Route Index; Carrier Identification Code. Circuit Code, and Carrier Selection; and TCM. Other feature-information not used by the processing modelled by this PIC (e.g. call forwarding, generic name, and business group information) may also be passed to the terminating call portion.

For an ISDN caller, during the processing that this PIC models, the SSF/CCF returns a CALL PROCeeding message. For non-ISDN lines, conventional trunks, and private-facility trunks, no treatment is applied.

For SS7-supported trunks, if the received IAM indicates a continuity check is required in this circuit, the procedures for performing the continuity check are followed. If the continuity check is successful, an indication of continuity success is passed to the terminating call portion. If the received IAM indicates a continuity check is being performed on a previous circuit in the connection, upon receiving a COT with a successful indication, this indication is passed to the terminating call portion.

Information available: After the SSF/CCF determines the call has been delivered (to the terminating half), it is assumed the SSF/CCF has the following information available with restrictions as noted:

- Calling Party Number, Calling Party Business Group ID, Class of Service, Bearer Capability, Calling Facility Group, Calling Facility Group Member, Service Profile Identifier, Facility Information other feature-related information - This information is available for each access type under the conditions defined in the O_Null PIC;
- Analysis Results - see description in the Analyse_Information PIC;
- Routing Information - see description in the Select_Route PIC;

- Facility Restriction Level - as described under the Collect_Information PIC.

Exit events:

- A route failure event is detected when:

  i) an indication of a T_Busy event specifying route busy; or

  ii) a Call Rejected event specifying route busy (received when the route is found to be busy at a switch other than the local switch) is received from the terminating call portion. In both cases, the originating call portion returns to the Select_Route PIC. This event is not detected at a DP in IN CS2;

  iii) the following conditions are met, hereafter called Route Failure Condition 1:

    a) an indication of a T_Busy event specifying route busy (received when the route at the local switch is found to be busy) is received from the terminating call portion (presentation failure event from the Present Call DP);

    b) the route was determined by switch translations at the Analyse_Information PIC;

  iv) the following conditions are met, hereafter called Route Failure Condition 2:

    a) a Call Rejected event specifying route busy (received when the route is found to be busy at a switch other than the local switch) is received from the terminating call portion (presentation failure event from the Present Call PIC);

    b) the route was determined by the switch translations at the Analyse Information PIC;

  v) the following condition is met, hereafter called Route Failure Condition 3:

    a) O_Called_Party_Busy event or O_No_Answer event occurs (as specified below).

  NOTE: The Route_Failure event takes precedence over the O_Called_Party_Busy and O_No_Answer events.

  In all five cases, the originating call portion returns to the Select_Route PIC. This event is not detected at a DP in IN CS2.

- An O_Answer event occurs when an indication of a T_Answer event is received from the terminating call portion. This event causes call processing to move to the O_Answer DP.

- An O_Term_Seized event occurs when an indication of a call accepted event is received from the terminating call portion or when certain abnormal cases occur in ISDN when the call is offered to an ISDN interface and no user equipment has responded, but an "indication to apply audible ringing" is sent from the terminating call portion to the originating call portion and as a result, audible ringing is to be sent to the caller. In ISDN this occurs, for example, when a call is offered to the interface with a SETUP message and the call setup timer T303 is initiated. If T303 expires and no response is received, the switch retransmits the SETUP message, re-initializes T303, and sends in-band audible ringing back to the caller. If the call is from an ISDN user, a PROGress message is also sent containing progress indicator #10, "delay in response at called interface" and progress descriptor #8, "in-band tone or pattern not available". In this case, the calling party receives in-band audible ringing, however, the called party has not accepted the call. When the O_Term_Seized event occurs, the treatment applied depends on the originating access type.

- A service feature request is received from the originating party: e.g. hook-flash, ISDN feature activator, DTMF provided control code(DP: O_Mid_Call).

No additional actions are taken in a non-ISDN line or private facility trunk.

For a call originating from an ISDN interface, the caller also receives an ALERTing message or under certain conditions a PROGress message containing progress indicator information set to "in-band information or pattern now available".

For SS7-supported trunks, an Address Complete Message (ACM) is sent.

In these cases, audible ringing, if applicable, is being sent from the originating call portion of the terminating switch.

- The O_No_Answer event is an IN event. That is, it can only occur when an O_No_Answer trigger is assigned and detected or when requested by a RequestReportBCSMEvent. If the O-No_Answer timer expires or an indication of the T_No_Answer event is received before an O_Answer event is detected (i.e. before the called party answers), the SSF/CCF reports the event to the SCF.

- The O_Called_Party_Busy event occurs when an indication of a T_Busy event specifying user busy is received from the terminating portion of the call (e.g. network-determined-user-busy, user not reachable). This event also occurs when an indication of a Call Rejected event specifying user busy (i.e. user-determined-user busy) is received from the terminating portion of the call. For calls originating from non-ISDN lines, conventional trunks, and private-facility trunks, if an indication of busy is received from the terminating portion of the call and no originating triggers or requested events apply, busy tone is provided.

  In addition to these busy events, the following "Call Rejected" conditions are also treated as O_Called_Party_Busy events:

  i) a Termination Denied event is received from the terminating call portion (Authorize_Termination PIC); or

  ii) an indication of a Call Rejected event is received from the terminating call portion (T_Alerting PIC) that does not specify busy. An example of a Call Rejected event that does not specify busy is the case when a call is offered to an ISDN interface; and either

    i) no user has responded with an ALERTing or CONNect message when the call setup timers expire; or

    ii) if the terminating user returns a call clearing message with a cause value of something other than "busy".

  In this case, the terminating portion of the call is cleared.

- For SS7-supported trunk interface, the authorization_route_failure event occurs when the continuity check procedure results in failure. This event causes a BCSM transition to the O_Exception.

- Originating party abandons call (DP: O_Abandon).

4.2.2.1.8 O_Alerting

Entry event: O_Term_Seized event (DP: O_Term_Seized).

Function:

- Wait for the terminating party to answer. At this point, the caller receives in-band audible ringing (from the terminating switch). For a call originating from an ISDN interface, the caller also receives an ALERTing message or, under certain conditions, a PROGress message containing progress indicator information set to "in-band information or pattern now available".

- An indication of a call progress event may be received from the terminating call portion. This may result in a CPG being sent on an SS7-supported trunk (if the originating access is an SS7-supported trunk) or an ALERTing or PROGress message being sent on an ISDN interface (if the originating access is an ISDN interface).

Information available: When the SSF/CCF is in this PIC, it is assumed the SSF/CCF has the following information available with restrictions as noted:

- Calling Party Number, Calling Party Business Group ID, Class of Service, Bearer Capability, Calling Facility Group, Calling Facility Group Member, Service Profile Identifier, Facility Information, other feature-related information - This information is available for each access type under the conditions defined in the O_Null PIC.

- Analysis Results - see description in the Analyse_Information PIC.

- Routing Information - see description in the Select_Route PIC.

- Facility Restriction Level - as described under the Collect_Information PIC.

Exit events:

- The O_Answer event occurs when an indication of a T_Answer event is received from the terminating portion of the call (e.g. terminating party goes off hook, EN 300 403-1 [2] Connect message received, ISDN-UP Answer message received) (DP: O_Answer). When the O_Answer event occurs, the treatment applied is described in the Send_Call PIC.

- A service feature request is received from the originating party: e.g. hook-flash, ISDN feature activator, DTMF provided control code. (DP: O_Mid_Call).

- A route failure event is detected when:

  i) the following condition is met, here after called Route Failure Condition 3:

     a) O_Called_Party_Busy event or O_No_Answer event occurs (as specified below).

NOTE: The Route Failure event takes precedence over the O_Called_Party_Busy and O_No_Answer events.

  In this case, the originating call portion returns to the Select_Route PIC. This event is not detected at a DP in IN CS2.

- The O_No_Answer event from this PIC is the same as the O_No_Answer event defined as an Exit Event from the Send_Call PIC (DP: O_No_Answer).

- From this PIC, the O_Called_Party_Busy event occurs when either:

  i) a Call Rejected event specifying user busy is received; or

  ii) an indication of a Call Rejected event not specifying busy is received from the terminating call portion (as described in the Send_Call PIC).

  In addition, for a call to an ISDN user, after the SETUP message is offered and an ALERTing message has been received (i.e. the terminating call portion is in the T_Alerting PIC), the ISDN user may reject the call. This Call Rejected event is treated as an O_Called_Party_Busy event by the originating call portion. (DP: O_Called_Party_Busy).

- Originating party abandons call (DP: O_Abandon).

4.2.2.1.9 O_Active

Entry event: Indication from the terminating half BCSM that the call is accepted and answered by terminating party. (DP: O_Answer).

Function: In this PIC several processes may be initiated:

- Connection established between originating and terminating party. Message accounting / charging data may be being collected. Call supervision is being provided.

- The called party may be put on hold and returned to the active phase by a service logic.

Information available: Once the SSF/CCF has received an indication from the terminating half BCSM that the call has been answered, it is assumed the SSF/CCF has the following information available with restrictions as noted:

- Information as per the O_Alerting PIC.

- Feature Activation - A service or feature request from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, EN 300 403-1 [2] HOLD or RETRIEVE message for originating party only). (O_Mid_Call DP).

Exit events:

- A service / service feature request is received from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, EN 300 403-1 [2] HOLD or RETRIEVE message for an originating party only). (DP: O_Mid_Call).

- A disconnect indication is received from the terminating party via the terminating half BCSM. (DP: O_Suspend). A disconnect timing is associated with this BCSM transition.

- A disconnect indication (e.g. on-hook, EN 300 403-1 [2] disconnect message, SS7 release message) is received from the originating party. (DP: O_Disconnect).

- A connection failure occurs. (O_Exception).

Comments:

- Disconnect treatment and timing is different for call attempts originating from ISDN and analogue line interfaces.

Corresponding EN 300 403-1 [2] call state: 10. Active

EN 300 403-1 [2] call states corresponding to disconnect: 11. Disconnect request, 12. Disconnect indication and 19. Release request.

4.2.2.1.10 O_Suspended

Entry event: A suspend indication is received from the T_BCSM when the terminating party has disconnected (e.g. on-hook). (DP: O_Suspend).

Function:

- The connection between the originating and terminating party is maintained and depending on the incoming network connection, appropriate backward signalling takes place.

  - In case that a disconnect indication is received from the T_BCSM, this PIC is immediately exited to the O_Disconnect DP without any action. As an option, the call can be continued for an appropriate period in order to offer follow-on initiated by O_Mid_Call.

  - If the re-answer indication from the T_BCSM is received, the originating and terminating parties are reconnected.

  - Other features which might be required during this PIC are not described in the IN CS2 BSCM.

- The called party may be put on hold and returned to the active phase by a service logic.

Information available: It is assumed that the information available in this PIC is the same as the information available in the O_Active PIC.

Exit event:

- Connection to the terminating party is resumed. The O_BCSM returns to the O_Active PIC.

- A service feature request is received from the originating party, e.g. hook flash, ISDN feature activator of facility, DTMF provided control code (DP: O_Mid_Call).

- A disconnection indication is received from the originating party (DP: O_Disconnect).

- A disconnection indication is received from the terminating party (DP: O_Disconnect).

- An indication of expiration of the timer waiting for re-answer request is received from the T_BCSM (DP: O_Disconnect).

- A trigger at O_Mid_Call is not initiated during an appropriate period (DP: O_Disconnect).

- An exception event is encountered (O_Exception).

NOTE 1: A Call Retention timer may exist. Disconnect treatment and timing is different for call reconnection, call suspension and call retention.

NOTE 2: After the release of the outgoing connection, the originating party may initiate another call, e.g. follow-on calling.

4.2.2.1.11 O_Exception

Entry event: An exception condition is encountered (as described above for each PIC).

Function: Default handling of the exception condition is being provided. This includes general actions necessary to ensure no resources remain inappropriately allocated, such as:

- If any relationships exist between the SSF and SCF(s), send an error information flow to the SCF(s) closing the relationships and indicating that any outstanding call handling instructions will not run to completion (see note).
- If an SCF previously requested that call parameters be provided at the end of the call (see the call information request information flow in clause 6); these should be included in the error information flow.
- The SSF/CCF should make use of vendor-specific procedures to ensure release of resources within the SSF/CCF so that line, trunk, and other resources are made available for new calls.

NOTE: This should be handled in the physical plane via an ABORT protocol to close the relationship (i.e. close the TCAP transaction) and indicate that any outstanding operations will not be run to completion. Within a CPH environment the occurrence of an exception for an entity (CS, BCSM) may be reported to the SCF with the operation EntityReleased. This is appropriate when the relationship has to be kept because of other existing entities (CS, BCSM), which are not affected by this exception.

Information available: Once the SSF/CCF has determined an exception condition has occurred, it is assumed the SSF/CCF has information available as when the exception within the PIC occurred.

Exit event: Default handling of the exception condition by the SSF/CCF completed (BCSM transition to O_Null PIC).

4.2.2.2 Terminating BCSM for IN CS2

The terminating half of the BCSM corresponds to that portion of the BCSM associated with the terminating party (see figure 4.2).

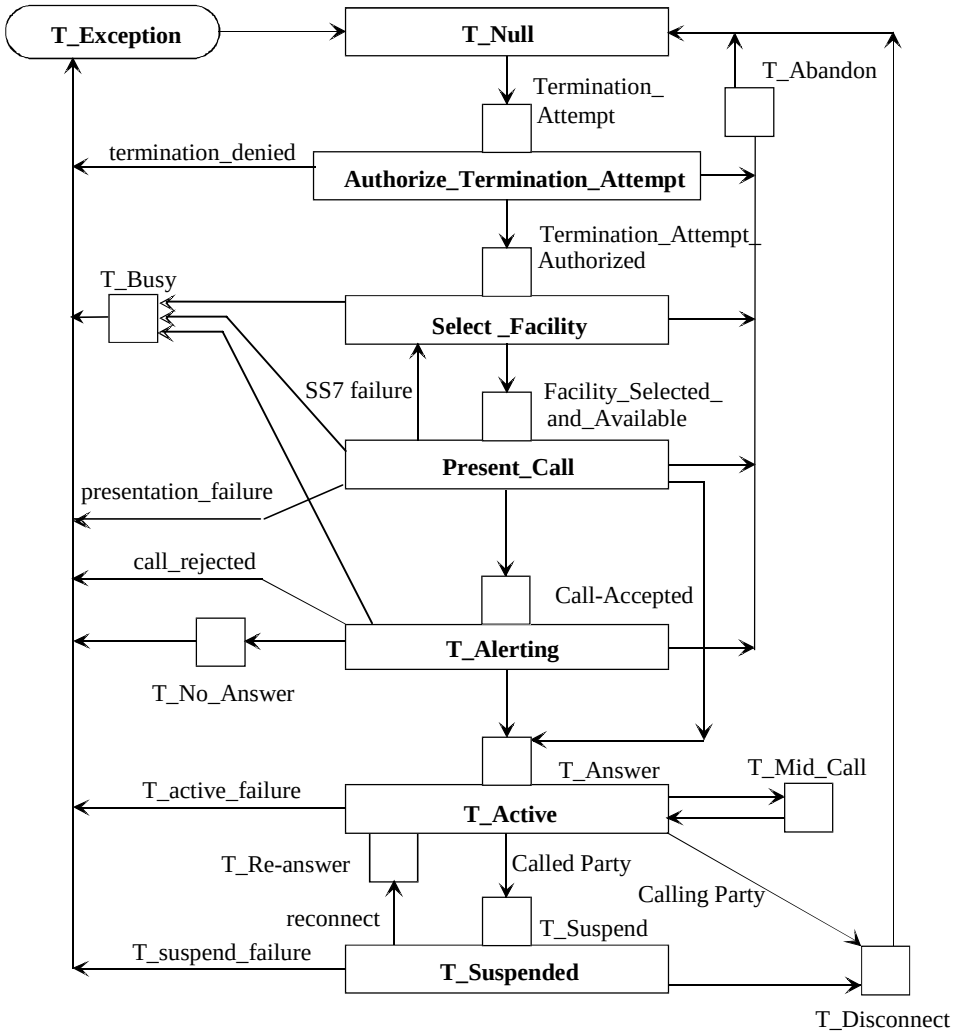


Figure 4.2: Terminating BCSM for CS2

The following information is available at all PICs in the T-BCSM:

- Calling Party Category - see ITU-T Recommendation Q.762 [3] Calling Party's Category signalling information.

  Forward GVNS - see ITU-T Recommendation Q.762 [3] Forward GVNS element.

- SRF/SSF capabilities - see ITU-T Recommendation Q.1290 [8]. Used to decide if an assist of hand-off procedure is to be used.

- Call Gapping Encountered - see ITU-T Recommendation Q.1290 [8].

- Terminal Type - see ITU-T Recommendation Q.1290 [8]. The SCF uses this to determine the most appropriate form of user-interaction to use (e.g. in-band announcements). This information is only available at originating or terminating local exchanges.

- Location Number - see ITU-T Recommendation Q.762 [3] Location Number signalling information. Used if the calling party is a mobile subscriber.

- Original Called Party Number - see ITU-T Recommendation Q.762 [3]. This information is received from the originating call portion.

- Redirecting Party ID - see ITU-T Recommendation Q.762 [3]. This information is received from the originating call portion.

- Redirection Information - see ITU-T Recommendation Q.762 [3]. This information is received from the originating call portion.

- ISDN Access Related Information: - see ITU-T Recommendation Q.762 [3] Access Transport Parameter.

The descriptions for each of the PICs in the terminating half of the BCSM are described below.

NOTE: See BCSM Indications of subclause 4.2.4 for more information concerning PICs.

4.2.2.2.1 T_Null

Entry event: Disconnect and clearing of a previous call (DPs: T_Disconnect or T_Abandon), or default handling of exceptions by SSF/CCF completed.

Function: Interface (line / trunk) is idled (no call exists, no call reference exists, etc.). Supervision is being provided.

Information available: Once the SSF/CCF has detected the Termination_Attempt event it is assumed the following information is available and associated with the terminating portion of the call with restrictions as noted (information associated with the originating portion of the call as per the Send_Call PIC is assumed to be still available):

- Calling Party Number; Calling Party Business Group ID, Bearer Capability - Available for each access type under conditions identified in the O_Null PIC. This information is received from the originating call portion.
- Calling Party Category - see ITU-T Recommendation Q.762 [3]. Determined by the Class of Service information, ISDN User Part originating line information parameter (see ITU-T Recommendation Q.1290 [8]), or information from EAMF signalling.
- Called Party Number, Carrier, Carrier Identification Code, Circuit Code, Carrier Selection; Route Index; and Travelling Class Mark - This information is received from the originating call portion.
- Class of Service of Terminating Access - see ITU-T Recommendation Q.1290 [8]. This is either a Customer Class of Service (see ITU-T Recommendation Q.1290 [8]), a Trunk Class of Service (see ITU-T Recommendation Q.1290 [8]), or a Private-Facility Class of Service (see ITU-T Recommendation Q.1290 [8]) for the Terminating Access (Dialled Number, Circuit, or trunk group).
- Called Party Subaddress - see EN 300 403-1 [2].
- Calling Party Subaddress - see EN 300 403-1 [2].
- Called Party BGID - see ITU-T Recommendation Q.1290 [8]. This information is determined in this PIC when the terminating party is a member of a Business Group and is served by a non-ISDN line or DSS 1 interface on this SSF/CCF.

Exit event:

- Indication of incoming call received from originating half BCSM. (DP: Termination_Attempt).
- The following exception exit events is applicable to this PIC: T_Abandon. If the call encounters T_Abandon during PIC processing, the exception event is not visible because there is no corresponding DP.
- Corresponding EN 300 403-1 [2] call state: 0. Null.

4.2.2.2.2 Authorize_Termination_Attempt

Entry event: Termination_Attempt event. (DP: Termination_Attempt).

Function: Verifies the authority to route this call to the terminating access (e.g. DN or trunk group), e.g. check business group restrictions, restricted incoming access to line, or bearer capability compatibility.

Information available: It is assumed that the SSP has the same information available for the terminating call portion after the Termination_Authorized event is detected as it does when the Termination_Attempt event is detected.

Exit events:

- Termination_Attempt_Authorized event. This event occurs when the switch has verified the authority to terminate the call to the terminating access (DP: Termination_Attempt_Authorized).

- The Termination Denied event occurs when the authority to route these call to the terminating user is denied. (This causes a BCSM transition to the T_Exception.)

- The T_Abandon event occurs when an indication of clearing is received from the originating portion of the call (DP: T_Abandon).

4.2.2.2.3 Select Facility

Entry event: Termination_Attempt_Authorized event (DP: Termination_Attempt_Authorized) or an SS7 failure occurs causing a re attempt. The SS7 failure in the Present_Call can be caused by a timer expiry upon sending a continuity check failure.

Function: The busy / idle status of the terminating access is determined.

- For a non-ISDN line, if the line is already involved with an existing call, the line is treated as network-determined user busy.

- For a call terminating to an ISDN interface (on a non-shared DN/CT), network-determined user busy is the detection of one or more of the following conditions:

  - Interface busy: That is, a B-channel is not available for the call.

  - Call-reference busy: There are no idle call reference values available on the terminating DN/CT with which the call can be offered.

    In addition, if the terminating DN is associated with an Multi-Line Hunt Group, busy means that no hunt terminals within the group are available and the queue, if any, is full.

  - For conventional trunks, SS7-supported trunks, and private-facility trunks, busy is when all trunks within the selected trunk group are busy.

Information available: When the Facility_Selected and Available event is detected, it is assumed the following information is available and associated with the terminating portion of the call with restrictions as detailed noted:

- Information as per the T_Null PIC.

- Facility Group - see ITU-T Recommendation Q.1290 [8]. For calls routed out of this SSF/CCF, this identifies the Trunk Group (private or public) that has been selected to route the call on. For calls terminating to a non-ISDN line or DSS 1 interface within the SSF/CCF, this may identify a particular Multi-line Hunt Group.

- Facility Group Member - see ITU-T Recommendation Q.1290 [8]. For calls out of this SSF/CCF, this identifies the trunk (private or public) that has been selected to route the call on. For calls terminating to a non-ISDN line DSS 1 interface on the SSF/CCF, this may identify the hunt-terminal within the Multi-line Hunt Group that has been selected for this call.

Exit events:

- Facility_Selected_and_Available event: This event occurs when the terminating access is not busy (i.e. an idle facility [e.g. B-channel, call appearance, or trunk] could be found) (DP: Facility_Selected_and_Available).

- A T_Busy event occurs when the terminating access is busy (as defined above). The T_busy event may also be detected as a result of an analogue line being out of order, marked as busy by a customer make-busy key, or as a result of certain maintenance actions (DP: T_Busy).

  After detecting T_Busy, if IN service logic is not needed on the call and no switch-based features apply, an indication of the T_Busy event describing the type of busy (e.g. user or network) is passed to the originating call portion. If a terminating feature acts on the T_Busy event and changes the event [e.g. as in the call Waiting feature], the event is not passed to the Originating BCM.

- The T_Abandon event occurs when an indication of clearing is received from the originating portion of the call.

4.2.2.2.4 Present Call

Entry event: Facility_Selected_and_Available event (DP: Facility_Selected_and_Available).

Functions: Terminating resource informed of incoming call (e.g. line seizure, EN 300 403-1 [2] Setup message, ISDN-UP IAM message). In the case of an analogue line, ringing is applied.

Information available: When the Call Accepted event is detected, it is assumed the following information is available and associated with the terminating portion of the call with restrictions as detailed noted:

- Information as per the T_Null PIC.
- Facility Group, Facility Group Member - See description in the Select Facility PIC.
- Information regarding the call connection - This information includes whether the call is end-to-end SS7 or not and whether the originating access is ISDN or non-ISDN.

Exit events:

- Terminating party is being alerted (e.g. ringing being applied, EN 300 403-1 [2] ALERTING message, ISDN-UP ACM message) (DP: Call_Accepted).
- Call is accepted and answered by terminating party (e.g. terminating party goes off-hook, EN 300 403-1 [2] CONNECT message received, ISDN-UP answer message received) (DP: T_Answer).
- Indication of originating party abandon received from originating half BCSM (DP: T_Abandon).
- A timer expiry upon sending acontinuity check failure (SS7 failure). This event causes call processing to move to the Select Facility PIC.
- Presentation Failure exception event may happen when a call cannot be presented and not detected by the T_Busy event.
- The T-Busy event occurs if the call cannot be presented due to an ISDN user determined busy, release message with busy cause, not reachable subscriber condition; this event causes call processing to move to the T_BusyDP and is notified to the originating call portion (Send_Call PIC). - Corresponding EN 300 403-1 [2] call state: 6. Call present.

4.2.2.2.5 T_Alerting

Entry event: Terminating party is being alerted of incoming call. (DP: Call_Accepted).

Function: An indication is sent to the originating half BCSM that if the terminating party is being alerted. Continued processing of call setup (e.g. ringing, audible ring indication) is taking place. Waiting for the call to be answered by terminating party.

Information available:

Once the terminating party is being alerted of the incoming call, it is assumed that information as per Present_Call PIC is available.

- Feature Activation - . For this PIC, a service or feature request from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, ITU-T Recommendation Q.932 [5] HOLD or RETRIEVE message for a terminating party only).

Exit events:

- Call is accepted and answered by terminating party (e.g. terminating party goes off-hook, EN 300 403-1 [2] CONNECT message received, ISDN-UP answer message received). (DP: T_Answer).
- Feature Activation - . For this PIC, a service or feature request from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, ITU-T Recommendation Q.932 [5] HOLD or RETRIEVE message for a terminating party only).
- The following exception exit events are applicable to this PIC: call rejected, T_No_Answer, T_Busy and T_Abandon.
    - Call rejected exception event may happen when an ISDN user rejects a call while be alerted.

- The T_No_Answer event occurs when the terminating party does not answer before the No_Answer timer expires. An indication of T_No_Answer event is passed to the originating half of the BCSM. This event leads to the T_No_Answer DP.

- The T_Busy event if the call cannot be presented due to an ISDN user determined busy, release message with busy cause, not reachable subscriber condition etc; this event causes call processing to move to the T_BusyDP and is notified to the originating call portion (Alerting PIC).- Indication of originating party abandon received from originating half BCSM (DP: T_Abandon).

Comment: For terminations to SS7 trunk groups, this PIC is entered upon the receipt of an address complete (ACM) message.

Corresponding EN 300 403-1 [2] *call states:* 7. Call received; and 8. Connect request.

4.2.2.2.6 T_Active

Entry events: Call is accepted and answered by terminating party (e.g. terminating party goes off hook, EN 300 403-1 [2] Connect message received, ISDN-UP answer message received) (DP: T_Answer).

Function: In this PIC several processes may be initiated:

- An indication is sent to the origination half BCSM that the terminating party has accepted and answered the call. Connection established between originating and terminating party. Call supervision is being provided.

- The calling party may be put on hold and returned to the active phase by a service logic.

Information available: Once the call is accepted and answered by the terminating party, it is assumed the following information is available and associated with the terminating portion of the call with restrictions as noted:

- Information as per T_Alerting.

- Feature Activation - see ITU-T Recommendation Q.932 [5]. For this PIC, a service or feature request from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, ITU-T Recommendation Q.932 [5] HOLD or RETRIEVE message for a terminating party only).

Exit events:

- A service / service feature request is received from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, EN 300 403-1 [2] HOLD or RETRIEVE message for a terminating party only) (DP: T_Mid_Call).

- A disconnect indication (e.g. on-hook, EN 300 403-1 [2] DISCONNECT message, SS7 release message) is received from the terminating party (DP: T_Suspend).

- A disconnect indication is received from the originating party via the originating half BCSM (DP: T_Disconnect).

- A connection failure occurs. (T_Exception).

Comments:

- Disconnect indications and treatment are asymmetrical in the way disconnect timing is applied.

Corresponding EN 300 403-1 [2] *call state:* 10. Active.

EN 300 403-1 [2] *call states corresponding to T_Disconnect:* 11. Disconnect request; 12. disconnect indication; and 19. Release request.

4.2.2.2.7 T_Suspended

Entry event: An indication is received from the outgoing network that the terminating party has disconnected (e.g. on-hook) (DP: T_Suspend).

Function: The physical resources associated with the call remain connected.

- According to the received indication the following applies:
- A suspend indication is sent to the originating half BCSM.
- For an SS7-supported trunk or an ISDN interface, in case that a disconnect indication (e.g. EN 300 403-1 [2] DISCONNECT message, SS7 release message) is received from the terminating party, this PIC is immediately exited to the T_Disconnect DP without any action.
- In the following cases, the timer is started and the call waits for re-answer request from the terminating party:

  1) For an SS7 supported trunk, in case of receiving network initiated suspend message.

  2) For an analogue interface, in case of detecting on-hook.

  If re-answer request (e.g. off-hook, SS7 resume message) is received from the terminating party before the timer expires, the originating and terminating parties are reconnected.

NOTE: Both a Call Resume timer and a Call Retention timer may exist in this PIC. IN implementations may use a single timer for both conditions.

Information available: While in the T_Suspended PIC, it is assumed that the SSP has the same information available for the terminating call portion as it has in the T_Active PIC.

Exit event:

- The terminating party re-answers or a resume message is receives before the timer expires; the T_BCSM returns to the T_Active PIC (DP: T_Re-answer).
- The timer expires (DP: T_Disconnect).
- A disconnection indication is received from the terminating party (DP: T_Disconnect).
- A disconnection indication is received from the originating party (DP: T_Disconnect).
- An exception event is encountered (T_Exception).

4.2.2.2.8 T_Exception

Entry event: An exception condition is encountered (as described above for each PIC).

Function: An indication of the exception condition is sent to the originating half BCSM. Default handling of the exception condition is being provided. This includes general actions necessary to ensure no resources remain inappropriately allocated, such as:

- If any relationships exist between the SSF and SCF(s), send an error information flow to the SCF(s) closing the relationships and indicating that any outstanding call handling instructions will not be run to completion (see note).
- If an SCF previously requested that call parameters be provided at the end of the call (see the call information request information flow in 6), these should be included in the error information flow.
- The SSF/CCF should make use of vendor-specific procedures to ensure release of resources within the SSF/CCF so that line, trunk, and other resources are made available for new calls.

NOTE: This should be handled in the physical plane via an ABORT protocol procedure to close the relationship (i.e. close the TCAP transaction) and indicate that any outstanding operations will not be run to completion. Within a CPH environment the occurrence of an exception for an entity (CS, BCSM) may be reported to the SCF with the operation EntityReleased. This is appropriate when the relationship has to be kept because of other existing entities (CS, BCSM), which are not affected by this exception.

Information available: Once the SSF/CCF has determined an exception condition has occurred, it is assumed the SSF/CF has information available as when the exception within the PIC occurred.

Exit event: Default handling of the exception condition by SSF/CCF completed (BCSM transition to T_Null PIC).

4.2.3 BCSM Resume Points and BCSM Transitions in the IN CS2 Call Model

The following tables 4.1 and 4.2 together with figures 4.3 and 4.4 describe the complete set of possible BCSM transitions for the IN CS2 originating and terminating call models. The nature of the BCSM transitions is given in the third column.

Table 4.1: Complete Set of BCSM Transitions for the IN CS2 Model (Originating BCSM)

Basic: The basic call process resumes in sequence of DP (e.g. Continue)

SCF Extended: The basic call process progresses due to SCF PIC instruction (e.g. Connect).

CCF Extended: The basic call process progresses due to CCF call control instruction (e.g. Operator signal for call intrusion when call suspended at 'Busy' DP).

From	To	Nature of BCSM Transitions
Origination_Attempt DP	Authorize_Origination_Attempt PIC	Basic
	Collect_Information PIC	SCF Extended
	Analyse_Information PIC	SCF Extended
	Select_Route PIC	SCF Extended
	O_Exception PIC	CCF Extended
	O_Abandon DP	CCF Extended
Orig._Attempt_Authorized DP	Collect_Information PIC	Basic
	Analyse_Information PIC	SCF Extended
	Select_Route PIC	SCF Extended
	O_Exception PIC	CCF Extended
	O_Abandon DP	CCF Extended
Collected_Information DP	Collect_Information PIC (Collect_NDigits)	SCF Extended
	Analyse_Information PIC	Basic
	Select_Route PIC	SCF Extended
	O_Exception PIC	CCF Extended
	O_Abandon DP	CCF Extended
Analysed_Information DP	Collect_Information PIC (Collect_NDigits)	SCF Extended
	Analyse_Information PIC	SCF Extended
	Select_Route PIC	Basic
	O_Exception PIC	CCF Extended
	O_Abandon DP	CCF Extended
O_Term_Seized DP	O_Alerting PIC	Basic
	O_Active PIC (O_Disconnect)	SCF Extended
	O_MidCall DP (O_Alerting PIC)	CCF Extended
	O_Exception PIC	CCF Extended
	O_Abandon DP	CCF Extended
Route_Select_Failure DP	Collect_Information PIC (Collect_NDigits)	SCF Extended
	Analyse_Information PIC	SCF Extended
	Select_Route PIC	SCF Extended
	O_Abandon DP	CCF Extended
	O_Exception PIC	Basic

From	To	Nature of BCSM Transitions
O_Called_Party_Busy DP	Collect_Information PIC (Collect_NDigits) Analyse_Information PIC Select_Route PIC O_Abandon DP O_Exception PIC	SCF Extended SCF Extended SCF Extended CCF Extended Basic
O_No_Answer DP	Collect_Information PIC (Collect_NDigits) Analyse_Information PIC Select_Route PIC O_Abandon DP O_Exception PIC	SCF Extended SCF Extended SCF Extended CCF Extended Basic
O_Answer DP	O_Active PIC (O_Answer) O_MidCall DP (O_Active) O_Exception PIC O_Disconnect dp	Basic CCF Extended CCF Extended CCF Extended
O_Suspend DP	O_Suspended PIC O_Disconnect DP O_Midcall DP (O_Suspended PIC) O_Exception PIC O_Active PIC (O_Disconnect)	Basic CCF Extended CCF Extended CCF Extended CCF Extended
O_Re-Answer DP	O_Active PIC O_Disconnect DP O_Midcall DP (O_Active) O_Exception PIC O_Active PIC (O_Disconnect)	Basic CCF Extended CCF Extended CCF Extended CCF Extended
O_Mid_Call DP (Send Call PIC)	Send_Call PIC O_MidCall DP (Send_Call PIC) O_Active PIC (O_Disconnect) O_Exception PIC O_Abandon DP	Basic CCF Extended CCF Extended CCF Extended CCF Extended
O_Mid_Call DP (O_Alerting PIC)	O_Alerting PIC O_MidCall DP (O_Alerting PIC) O_Active PIC (O_Disconnect) O_Exception PIC O_Abandon DP	Basic CCF Extended CCF Extended CCF Extended CCF Extended
O_Mid_Call DP (O_Active PIC)	O_Active PIC Analyse_Information PIC Select_Route PIC O_MidCall DP (O_Active PIC) O_Active PIC (O_Disconnect) O_Exception PIC O_Disconnect DP	Basic SCF Extended SCF Extended CCF Extended CCF Extended CCF Extended CCF Extended
O_Mid_Call DP (O_Suspended PIC)	O_Suspended PIC Analyse_Information PIC Select_Route PIC O_MidCall DP (O_Suspended PIC) O_Active PIC (O_Disconnect) O_Exception PIC	Basic SCF Extended SCF Extended CCF Extended CCF Extended CCF Extended
O_Disconnect DP	O_Null PIC Collect_Information PIC (Collect_NDigits) Analyse_Information PIC Select_Route PIC O_Exception PIC	Basic SCF Extended SCF Extended SCF Extended CCF Extended
O_Abandon DP	O_Null PIC	Basic
O_Null PIC	Origination_Attempt DP	Basic
Authorize_Origination_Attempt PIC	Origination_Attempt_Authorized DP O_Abandon DP O_Exception PIC	Basic Basic Basic
Collect_Information PIC	Collected_Information DP O_Abandon DP O_Exception PIC	Basic Basic Basic
Analyse_Information PIC	Analysed_Information DP O_Abandon DP O_Exception PIC	Basic Basic Basic

From	To	Nature of BCSM Transitions
Select_Route PIC	Analyse_Information PIC	Basic
	Authorize_Call_Setup PIC	Basic
	Route_Select_Failure DP	Basic
	O_Abandon DP	Basic
	O_Exception PIC	Basic
Authorize_Call_Setup PIC	Send_Call PIC	Basic
	O_Abandon DP	Basic
	O_Exception PIC	Basic
Send_Call PIC	O_Term_Seized DP	Basic
	O_Mid_Call DP (Send_Call PIC)	Basic
	O_Called_Party_Busy DP	Basic
	O_Answer DP	Basic
	O_No_Answer DP	Basic
	Select_Route PIC	Basic
	O_Abandon DP	Basic
	O_Active PIC (O_Disconnect)	CCF Extended
	O_Exception PIC	Basic
	Analyse_Information PIC	CCF Extended
O_Alerting PIC	Select_Route PIC	Basic
	O_Mid_Call DP	Basic
	O_Answer DP	Basic
	O_No_Answer DP	Basic
	O_Called_Party_Busy DP	Basic
	O_Abandon DP	Basic
	O_Active PIC (O_Disconnect)	CCF Extended
	O_Exception PIC	Basic
	Analyse_Information PIC	CCF Extended
O_Active PIC	O_Midcall DP	Basic
	O_Disconnect DP	Basic
	O_Suspend DP	Basic
	O_Active PIC (O_Disconnect)	CCF Extended
	O_Exception PIC	Basic
O_Suspended PIC	O_Re-Answer DP	Basic
	O_Mid_Call DP (O_Suspended PIC)	Basic
	O_Disconnect DP	Basic
	O_Exception PIC	Basic
O_Exception	O_Null PIC	Basic

Table 4.2: Complete Set of BCSM Transitions for the IN CS2 Model (Terminating BCSM)

Basic: The basic call process resumes in sequence of DP (e.g. Continue)

SCF Extended: The basic call process progresses due to SCF instruction PIC (e.g. Connect).

CCF Extended: The basic call process progresses due to CCF call control instruction (e.g. Operator signal for call intrusion when call suspended at 'Busy' DP).

From	To	Nature of BCSM Transition
Termination_Attempt DP	Authorize_Termination_Attempt PIC	Basic
	Select_Facility PIC	SCF Extended
	T_Answer DP	CCF Extended
	T_Abandon DP	CCF Extended
	Call Accepted DP	CCF Extended
	T_Exception PIC	CCF Extended
Terminating_Attempt_Authorized DP	Select_Facility PIC	Basic
	T_Answer DP	CCF Extended
	T_Abandon DP	CCF Extended
	Call Accepted DP	CCF Extended
	T_Exception PIC	CCF Extended
Facility_Selected_and_Available DP	Present_Call PIC	Basic
	T_Answer DP	CCF Extended
	T_Abandon DP	CCF Extended
	Call Accepted DP	CCF Extended
	T_Exception PIC	CCF Extended
Call_Accepted DP	T_Alerting PIC	Basic
	T_Answer DP	CCF Extended
	T_Abandon DP	CCF Extended
	T_Active PIC (T_Disconnect)	SCF Extended
	T_Exception PIC	CCF Extended
	T_MidCall DP (T_Active PIC)	CCF Extended
T_Busy DP	Select_Facility PIC	SCF Extended
	T_Answer DP	
	T_Abandon DP	CCF Extended
	Call Accepted DP	CCF Extended
	T_Exception PIC	CCF Extended
		Basic
T_No_Answer DP	Select_Facility PIC	SCF Extended
	T_Answer DP	CCF Extended
	Call Accepted DP	CCF Extended
	T_Exception PIC	Basic
T_Answer DP	T_Active PIC	Basic
	T_Active PIC (T_Disconnect)	SCF Extended
	T_MidCall DP (T_Active PIC)	CCF Extended
	T_Exception PIC	CCF Extended
T_Suspend DP	T_Suspended PIC	Basic
	T_Disconnect DP	CCF Extended
	T_Active PIC (T_Disconnect)	SCF Extended
	T_MidCall DP (T_Active PIC)	CCF Extended
	T_Exception PIC	CCF Extended
T_Re-Answer DP	T_Active PIC	Basic
	T_Disconnect DP	CCF Extended
	T_Active PIC (T_Disconnect)	SCF Extended
	T_MidCall DP (T_Active PIC)	CCF Extended
	T_Exception PIC	CCF Extended
T_Midcall DP	T_Active PIC	Basic
	T_Disconnect DP	CCF Extended
	T_Active PIC (T_Disconnect)	SCF Extended
	T_Exception PIC	CCF Extended
T_Disconnect DP	T_Null PIC	Basic
	T_Answer DP	CCF Extended
	Call_Accepted DP	CCF Extended
T_Abandon DP	T_Null PIC	Basic
T_Null PIC	Termination_Attempt DP	Basic

From	To	Nature of BCSM Transition
Authorize_Termination_Attempt PIC	Term_Attempt_Authorized DP	Basic
	T_Abandon DP	
	T_Exception PIC	Basic
		Basic
Select_Facility PIC	Facility_Selected_and_Available DP	Basic
	T_Busy DP	Basic
	T_Abandon DP	Basic
Present_Call PIC	T_Answer DP	Basic
	Call_Accepted DP	Basic
	T_Alerting PIC	Basic
	Select_Facility PIC	Basic
	T_Abandon DP	Basic
	T_MidCall DP (T_Active PIC)	CCF Extended
	T_Busy DP	Basic
	T_Active PIC (T_Disconnect)	CCF Extended
	T_Exception PIC	Basic
T_Alerting PIC	T_Answer DP	Basic
	T_No_Answer DP	Basic
	T_Abandon DP	Basic
	T_MidCall DP (T_Active PIC)	CCF Extended
	T_Active PIC (T_Disconnect)	CCF Extended
	T_Exception PIC	Basic
	T_Busy DP	Basic
T_Active PIC	T_Midcall DP	Basic
	T_Disconnect DP	Basic
	T_Suspend DP	Basic
	T_Active PIC (T_Disconnect)	CCF Extended
	T_Exception PIC	Basic
T_Suspended PIC	T_Re-Answer DP	Basic
	T_Disconnect DP	Basic
	T_MidCall DP (T_Active PIC)	CCF Extended
	T_Active PIC (T_Disconnect)	CCF Extended
	T_Exception PIC	Basic
T_Exception	T_Null PIC	Basic

The BCSM models illustrate that there may be sub PICs within a PIC, it is outside the scope of this part to provide any details on the behaviour which is covered in the SDL descriptions. . These figures however do not include all Sub-PICs as describe in the SDL model.

As an example the Collect-Ndigits sub-PIC is given to describe the behaviour of the collection of n digits, the O_Active Sub-PIC indicates the active state of a call, the O_Disconnect/ T_Disconnect Sub-PICs indicates the release of a call due to a Release Call or DisconnectLeg operation, the O_Suspended/ T_Suspended Sub-PICs indicates a network suspension of the call.

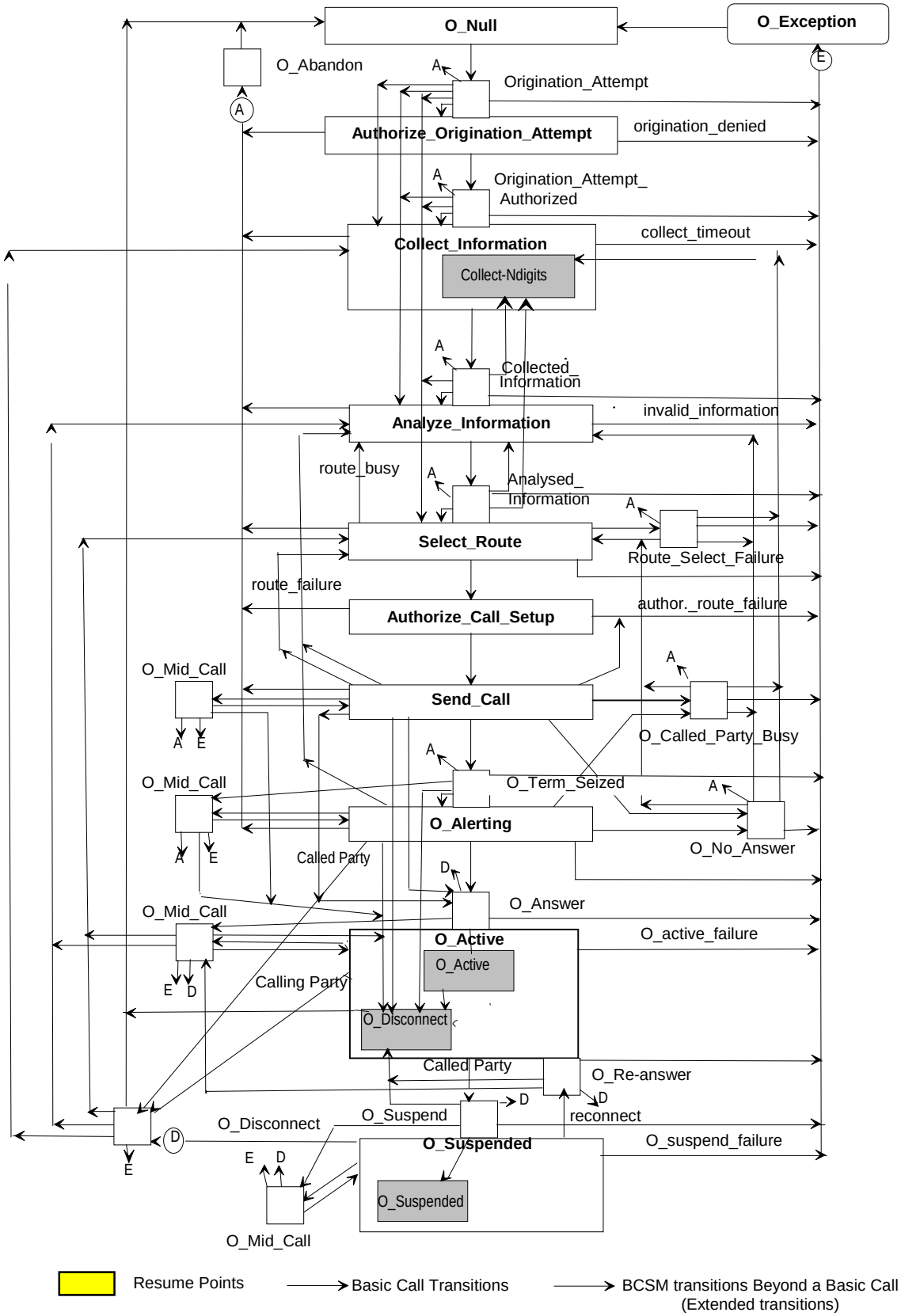


Figure 4.3: Complete Set of BCSM Transitions for the IN CS2 Originating Call Model

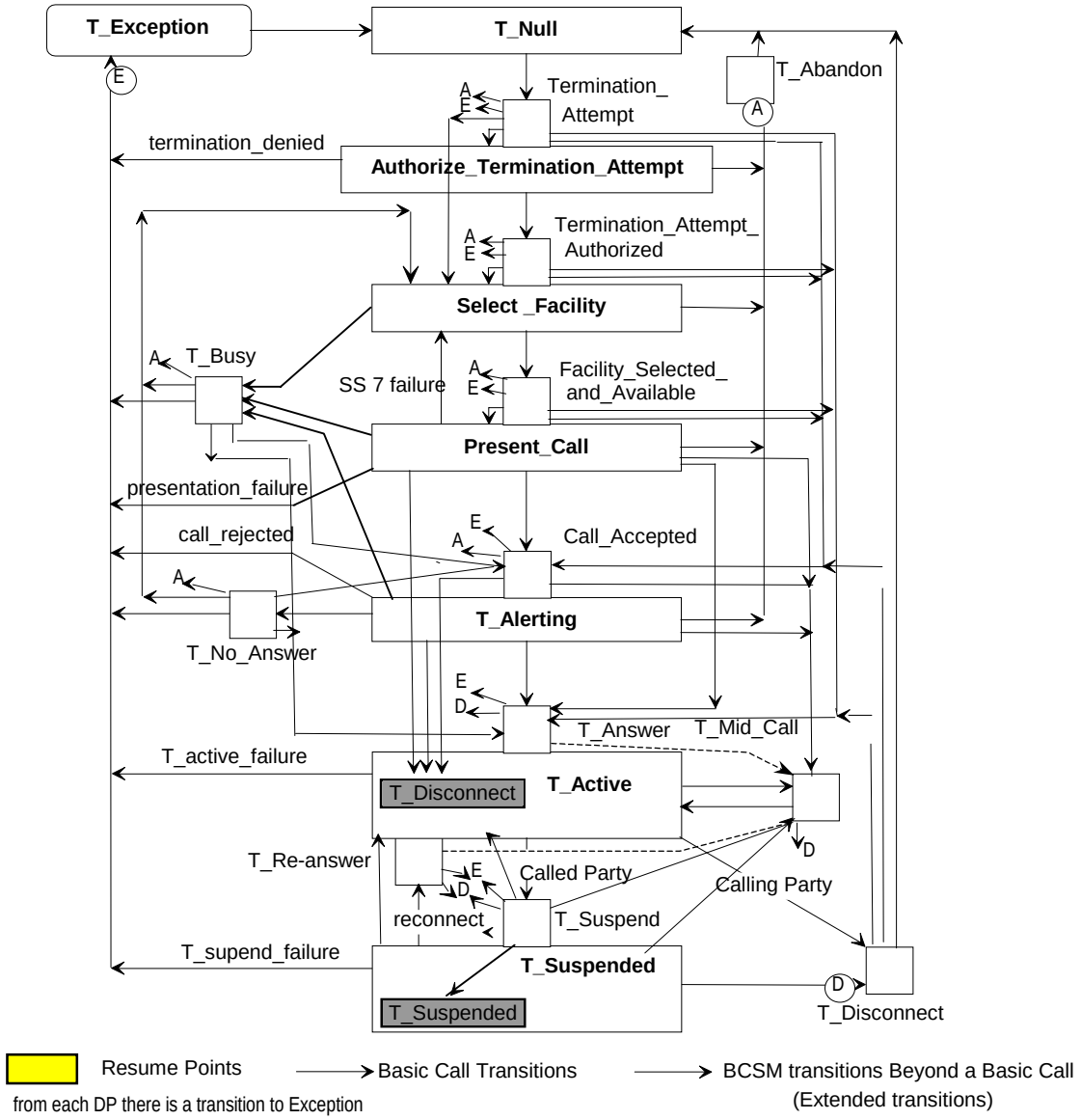


Figure 4.4: Complete Set of BCSM Transitions for the IN CS2 Terminating Call Model

4.2.4 BCSM indications for the CS2 Call Model

4.2.4.1 User - O_BCSM Access Signalling Indications (Category 1)

Definition

These Indications include the representation of the network's perception of possible actions taken by the calling party as well as the calling party's perception of actions taken by the network. The Indications are between a user (i.e. calling party) and a local exchange that is originating a call. They include the definition of how actions by the user (originating call model) affect the originating call model (user). These Indications are derived from Access Signalling (e.g. DSS 1, analogue) as well as any other information that is available. Figure 4.5 illustrates these indications.

Indications

(1) An Indication is sent from User to O_BCSM to initiate call establishment (e.g. SETUP).

(2) An Indication is sent from O_BCSM to User that network is unable to initiate call (e.g. RELEASE_COMPLETE).

(3) An Indication is sent from O_BCSM to User acknowledging the call initiation Indication (e.g. SETUP_ACKNOWLEDGE).

(4) The User sends call (dialling) information to the O_BCSM (e.g. INFORMATION).

(5) An Indication is sent from O_BCSM to the User to terminate the sending of call information (e.g CALL_PROCEEDING).

(6) An Indication is sent from the User to the O_BCSM upon completion of call information.

(7) User is informed that call has been routed to another environment of network (e.g. PROGRESS).

(8) An Indication is sent from the O_BCSM to the User when the called party is being alerted (e.g. ALERTING, CONNECT).

(9) An Indication is sent from the O_BCSM to the User when the call is accepted.

(10) The User acknowledges that the call is accepted.

(11) The O_BCSM sends an Indication to the User that the called party is unable to accept the call, due to busy condition or called party not reachable.

(12) The O_BCSM sends an Indication to the User since the called party is unable to accept the call, due to no answer condition.

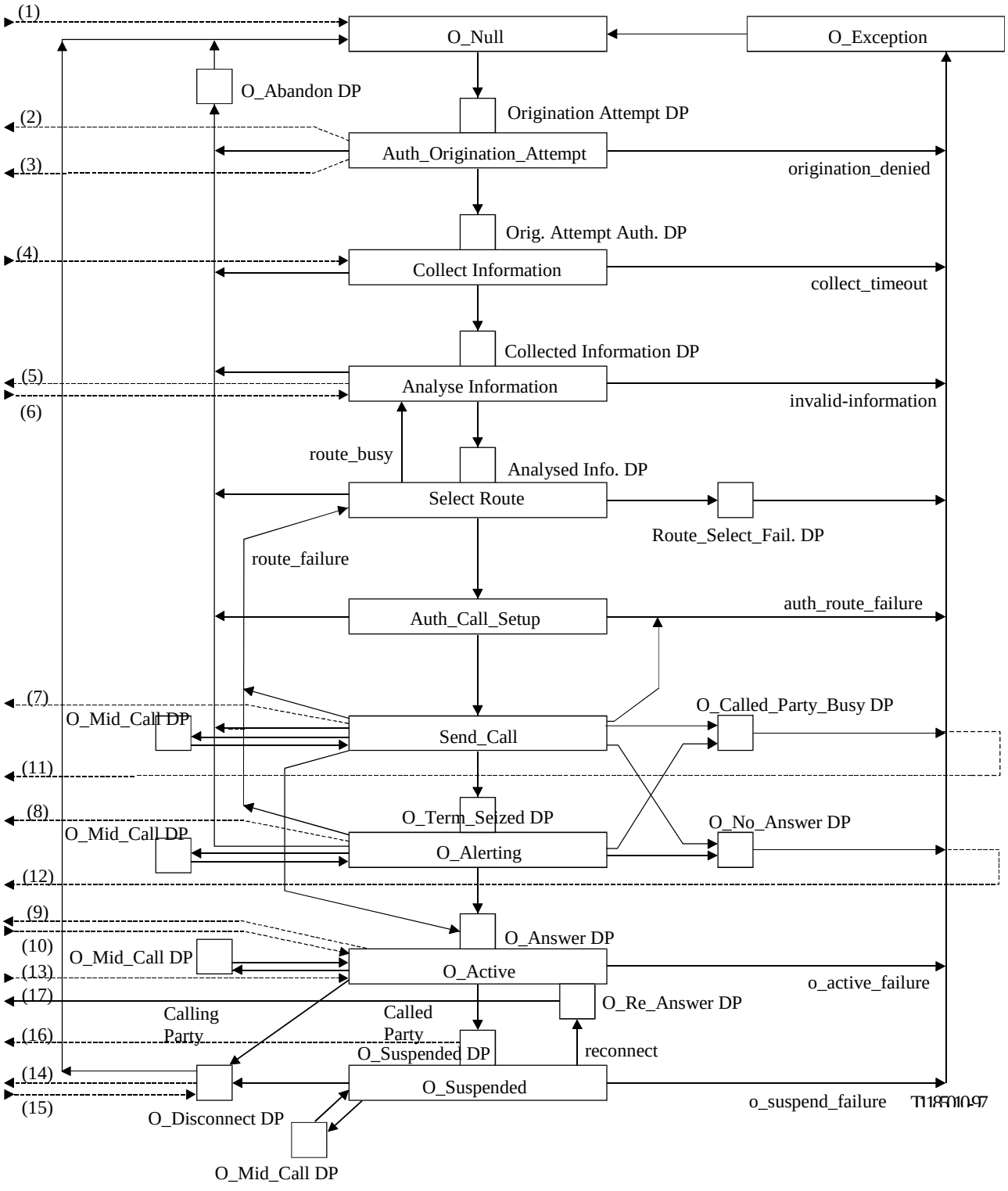
(13) An Indication is received by the O_BCSM from the User to end the call.

(14) The O_BCSM indicates to the User that the call is being disconnected.

(15) The User acknowledges to the O_BCSM that the call is being disconnected.

(16) An Indication is sent to the user when the connection towards the Called Party is suspended.

(17) An Indication is sent to the user when the connection towards the Called Party is reconnected.



NOTE: Indications which are shown as terminating on a DP in figure 4.8 are received by the switch and are not part of the IN DP Processing.

Figure 4.5: Access Signalling Indications for the CS2 BCSM Category 1 (User - O_BCSM)

4.2.4.2 T_BCSM - User Access Signalling Indications (Category 2)

Definition: These Indications include the representation of the network's perception of possible actions taken by the called party as well as the called party's perception of actions taken by the network. The Indications are between a local exchange that is terminating a call and a user (i.e. called party). They include the definition of how actions by the terminating call model (user) affect the user (terminating call model). These Indications are derived from Access Signalling (e.g. DSS 1, analogue) as well as any other information that is available. figure 4.6 illustrates these Indications.

Indications

(1) An Indication is sent from T_BCSM to the User to terminate the call to an idle facility (e.g. SETUP).

(2) An Indication is sent from User to T_BCSM indicating that the User cannot accept the call (e.g. RELEASE_COMPLETE).

(3) An Indication is sent from the User to the T_BCSM when the User determines compatibility with all call characteristics (e.g. SETUP_ACKNOWLEDGE).

(4) The T_BCSM sends any remaining call information to the User (e.g. INFORMATION).

(5) An Indication is sent from the T_BCSM to the User upon the sending of sufficient call information.

(6) An Indication is sent from the User to the T_BCSM upon receipt of sufficient call information (e.g. CALL_PROCEEDING).

(7) User sends an Indication to the T_BCSM that alerting is taking place (e.g. ALERTING).

(8) An Indication is sent from the User to the T_BCSM upon acceptance of the incoming call (e.g. CONNECT).

(9) An Indication is sent from the T_BCSM to the User acknowledging that the call can now be connected.

(10) An Indication is sent from the User to the T_BCSM that the User suspends the call.

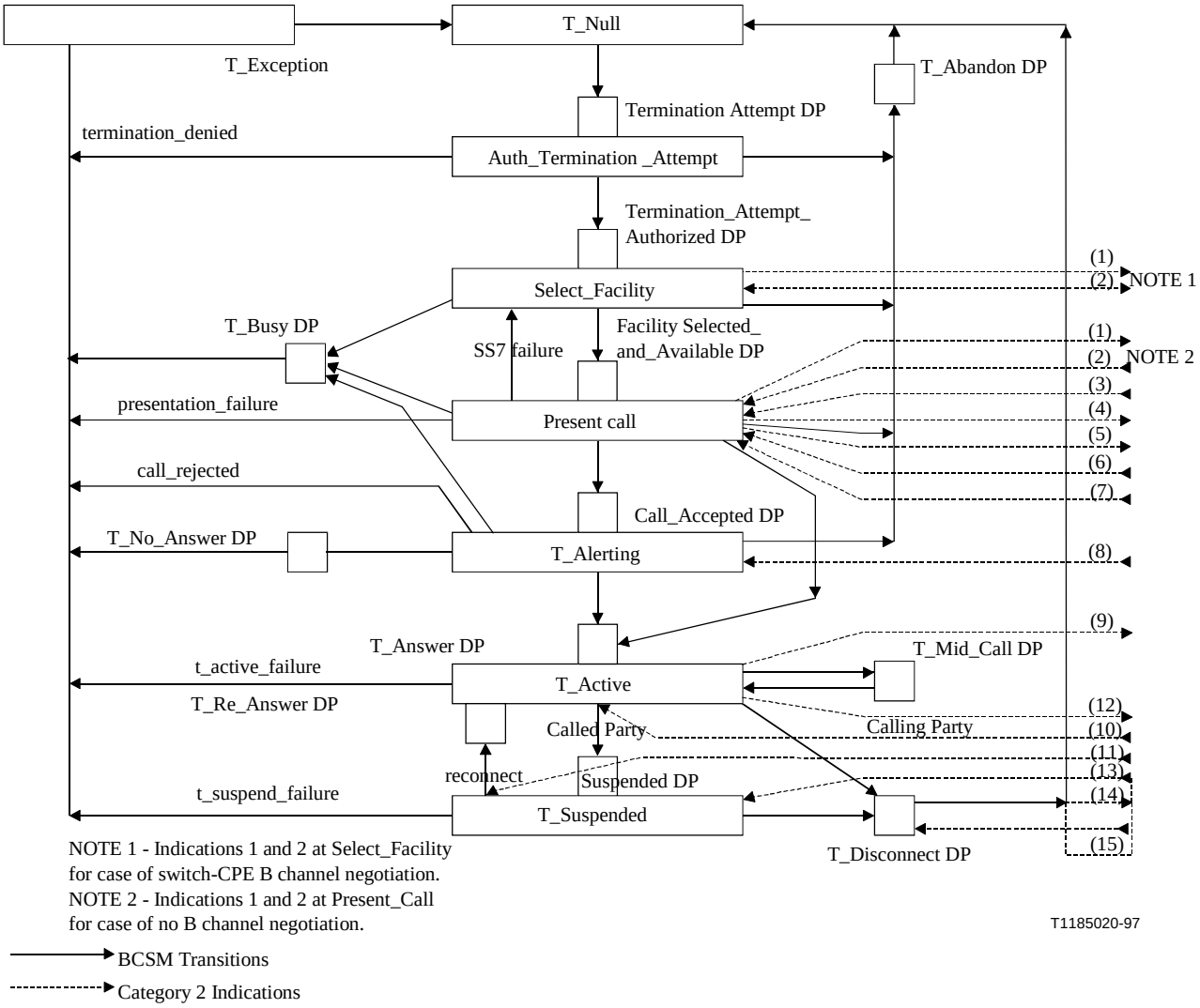
(11) An Indication is sent from the User to the T_BCSM that the User resumes the call.

(12) The T_BCSM sends an Indication to the User indicating that the calling party has gone on-hook.

(13) An Indication is received by the T_BCSM from the User to end the call.

(14) The T_BCSM indicates to the User that the call is being disconnected.

(15) The User acknowledges to the T_BCSM that the call is being disconnected.



NOTE 1: Indications 1 and 2 at Select_Facility for case of switch-CPE B channel negociation.
NOTE 2: Indications 1 and 2 at Present_Call for case of no B channel negociation.
NOTE 3: Indications which are shown as terminating on a DP are received by the switch and are not part of the IN DP processing.

Figure 4.6: Access Signalling for the CS2 BCSM Category 2 (T_BCSM-User)

4.2.4.3 Intra Local Exchange BCSM Indications (Category 3)

The following figure illustrates the communication between two call segments in the SSF/CCF for a basic two-party call, as described in 4.2.3.1. It shows the indications that flow between the originating and terminating BCSMs for CS2, as described in 4.2.2.2. All possible indications are shown, except for any which may occur at the O-Exception and the T-Exception PICs. Note that these indications are not intended to be mapped to explicit information flows.

(1) Initiate T_BCSM after the authority to place the call has been verified and a usable route has been identified. The O_BCSM is currently in the Send_Call PIC. The originating Basic Call Manager has sent the call attempt to the terminating Basic Call Manager for further processing.

(2) For SS7-supported trunks, if the received IAM indicates a continuity check is required and the resultant continuity check is successful, then an Indication is sent from the O_BCSM to the T_BCSM (causes T_Null PIC to Termination_Attempt DP BCSM transition in the T_BCSM).

(3) An Indication is sent from the T_BCSM to O_BCSM that the terminating line or trunk is busy. (Causes Send_Call PIC to O_Called_Party_Busy BCSM transition in O_BCSM, if terminating to a line. If terminating to a trunk, then this Indication causes Send_Call PIC to Select_Route PIC BCSM transition in the O_BCSM.)

(4) An Indication is sent from the T_BCSM to O_BCSM that the terminating line or trunk is busy. (Causes O_Alerting PIC to O_Called_Party_Busy DP BCSM transition in O_BCSM.)

(5) An Indication is sent from the T_BCSM to O_BCSM that the call cannot be presented. (Causes Send_Call PIC to Select_Route PIC, O_Called_Party_Busy DP, or O_No_Answer DP.)

(6) An Indication is sent from the T_BCSM to the O_BCSM that an ISDN capable Called Party has signalled call acceptance with immediate BCSM transition to an answered (i.e. CONNect message) condition. (Causes Send_Call PIC to O_Answer DP BCSM transition in O_BCSM).

(7) An Indication is sent from T_BCSM to O_BCSM that Called Party is being alerted (causes O_BCSM to transit from Send_Call PIC O_Alerting PIC and prepare to send ring Indication to the Calling Party).

(8) An Indication is sent from T_BCSM to O_BCSM that Called Party has rejected the call (this is indicated to the O_BCSM with a busy cause and causes O_BCSM to transit from O_Alerting PIC to Select_Route PIC or O_Called_Party_Busy DP).

(9) An Indication is sent from T_BCSM to O_BCSM that Called Party has not answered within a specified time period (causes O_Alerting PIC to O_No_Answer DP BCSM transition in O_BCSM).

(10) An Indication is sent from the T_BCSM to the O_BCSM that called party has not answered within a specified time period. (Causes Send_Call PIC to O_No_Answer DP BCSM transition in O_BCSM.)

(11) An Indication is sent from T_BCSM to O_BCSM that Called Party has accepted and answered the call attempt (causes O_Alerting PIC to O_Answer DP BCSM transition in O_BCSM).

(12) An Indication is sent from the T_BCSM to the O_BCSM that the called party has accepted and answered the call attempt. (Causes Send_Call PIC to O_Answer DP BCSM transition in O_BCSM.)

(13) An Indication is sent from T_BCSM to O_BCSM that Called Party has disconnected (e.g. on-hook). (Causes O_Active PIC to O_Suspended DP BCSM transition in O_BCSM).

(14) An Indication is sent from T_BCSM to O_BCSM that Called Party re-answers is received before the timer expires. (Causes O_Suspended PIC to O_Re_Answer DP BCSM transition in O_BCSM). Note that the name and function of this timer is FFS.

(15) An Indication is sent from O_BCSM to T_BCSM that Calling Party has disconnected, while T_BCSM was in T_Active PIC (causes T_Active PIC to T_Disconnect DP BCSM transition in T_BCSM).

(16) An Indication is sent from O_BCSM to T_BCSM that Calling Party has disconnected, while T_BCSM was in T_Suspended PIC. (Causes T_Suspended PIC to T_Disconnect DP BCSM transition in T_BCSM).

(17) An Indication is sent from T_BCSM to O_BCSM that Called Party has disconnected. (Causes O_Suspended PIC to O_Disconnect DP BCSM transition in O_BCSM).

(18) An Indication is sent from the T_BCSM (T_Disconnect DP) to O_BCSM that the calling party has disconnected. (Causes O_Active PIC to O_Disconnect DP BCSM transition in O_BCSM.)

(19) An Indication is sent from O_BCSM to T_BCSM that Calling Party has abandoned. (Causes Authorize_Termination_Attempt PIC, Select_Facility PIC, Present_Call PIC or T_Alerting PIC to T_Abandoned DP BCSM transition in T_BCSM).

NOTE: Indications (15) and (17) are mutually exclusive:

- these indications are for intra-switch;
- the indications do not explicitly include the modelling of SRFs;
- indications which are preceded by a DP may be affected depending on whether the DP is active and the SCF response.

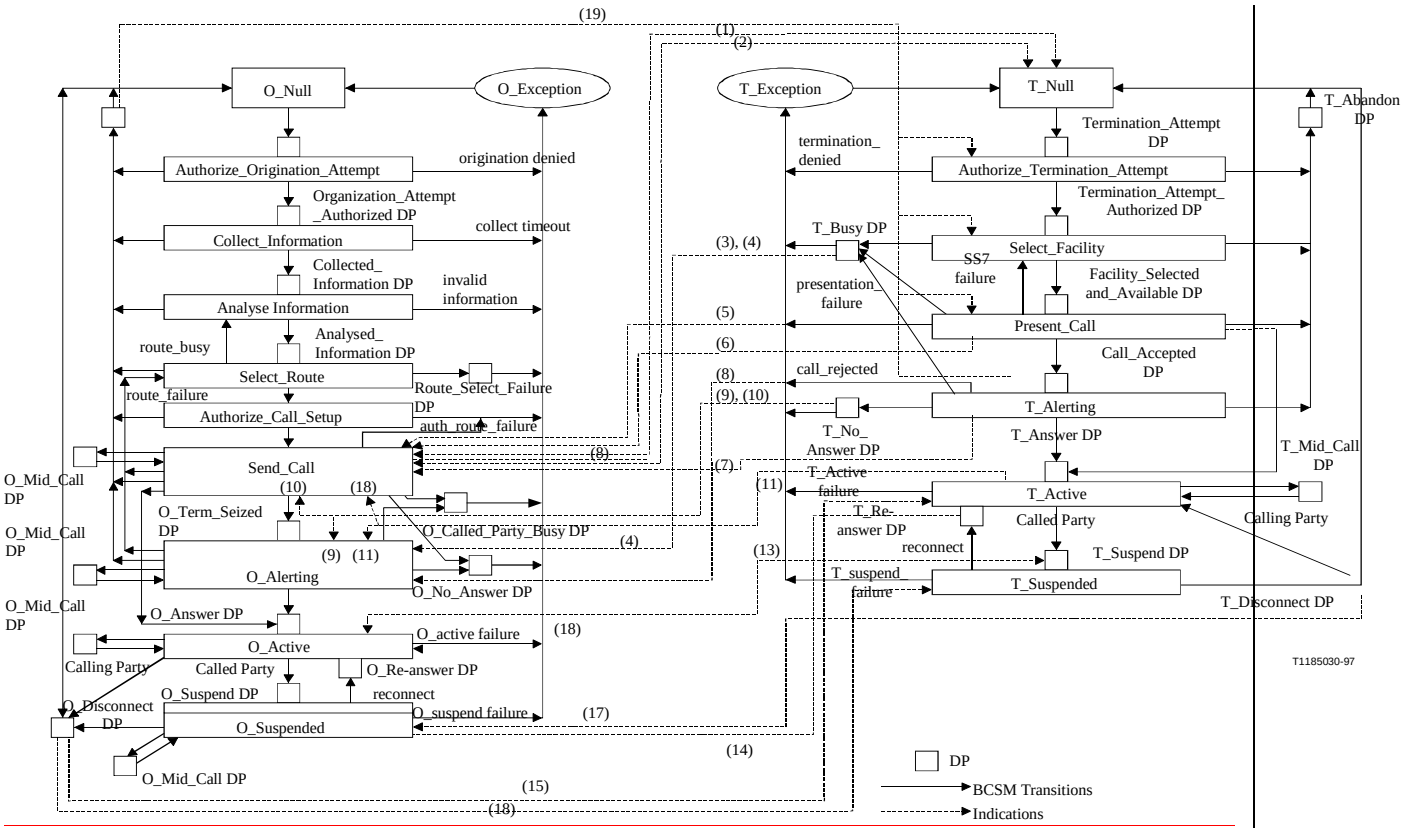


Figure 4.7

4.2.5 BCSM detection points

Text in subclause 4.2.5 of ITU-T Recommendation Q.1224 [6] shall be followed with the exception that TDP-N shall not be supported.

The definition of the terms "control relationship" and "monitor relationship" in subclause 4.2.5 of ITU-T Recommendation Q.1224 [6] is included below since it is of vital importance for an overall understanding of the INAP operation procedures:

Relationship - Given that an armed DP was encountered and DP criteria are met, the SSF may provide an information flow via a relationship:

1) If this relationship is between the SSF/CCF and the SCF for the purpose of call / service logic processing, it is considered to be an IN service control relationship. This relationship may be of two types:

   - a control relationship if the SCF is able to influence call processing via the relationship;

   - a monitor relationship if the SCF is not able to influence call processing via the relationship;

   - with respect to an IN service control relationship, the information flow provided by the SSF to the SCF on encountering a DP may initiate a control relationship, may be within the context of an existing control relationship, or may be within the context of an existing monitor relationship.

2) If this relationship is between the SSF/CCF and the SCF or SMF for management purposes, it is considered to be a service management control relationship. This relationship is for further study.

4.2.6 DP Criteria

As stated in 4.2.5, DP criteria are conditions that must be met in order to notify the SCF that the DP was encountered. These criteria can be assigned to a DP from the viewpoint of range of effectiveness, as identified below:

- *Individual line / trunk-based criteria*

  This type of criteria applies to each subscriber line or trunk line. For example, SCF processing is invoked when user A makes call origination. This criteria could be said to be specific for user A.

- *Group-based criteria*

  This type of criteria applies to a certain group of lines or users. For example, when a call origination from any user in a certain centrex group should invoke SCF processing the trigger should apply to that specific centrex group.

- *Office-based criteria*

  This type of criteria applies to the whole office. Any calls generated in the switching system will be subject to this criteria. For example, any call which makes access to the registered freephone number is triggered and SCF processing is invoked.

The following criteria are DP criteria for IN CS2, as applicable for a given DP:

- trigger assigned (unconditional / conditional on other criteria);
- class of service;
- specific B-channel identifier;
- specific digit strings;
- feature codes (e.g. *XX, #);
- prefixes (e.g. 0+, 00+, 0-, 00-, 011, 01, 1+);
- access codes (e.g. 8+) for customized numbering plan;
- specific abbreviated dialling strings for customized numbering plan;
- specific calling party number strings;
- specific called party number strings;
- nature of address (e.g. subscriber significant number, national significant number, international number);
- bearer capability;
- feature activation / indication (unconditional / conditional on specific feature patterns);
- facility information (unconditional / conditional on specific facility information patterns);
- cause (unconditional / conditional on specific cause patterns);
- specific value of USIServiceIndicator.

With respect to the DP criteria listed above, note that these DP criteria only apply to TDPs. DP criteria for Event Detection Points (EDPs) are addressed by the RequestReportBCSMEvent information flow. In addition, note that one or more DP criteria may be applicable at a given DP. The assignment of DP criteria to a TDP and the combinations of DP criteria applicable at a given DP continue to evolve. Further DP criteria and specific assignment of DP criteria to TDPs/EDPs may evolve through future capability sets.

NOTE 1: Further that the assignment of DP criteria to a TDP on either a line / trunk, group or office basis may have an impact on the memory and real-time performance requirements of the SSF/CCF. The DP criteria for IN CS2 are defined below, as applicable to a given TDP.

NOTE 2: The applicability of DP criteria at a given DP depends on when call processing information is available and how long it is retained. If network and service providers plan to implement IN CS2 services in a multi-supplier environment, they should consider formulating such requirements to ensure consistent implementations across supplier equipment. Such requirements should be considered carefully so as not to adversely impact memory and real-time performance aspects of SSF/CCF processing.

1) *Trigger assigned* (unconditional / conditional on other criteria) - An indicator of the armed / disarmed status of a TDP assigned on a line / trunk, group, or office basis.

NOTE 3: It is possible that some DPs are always conditional. Further study may be required.

The trigger assigned criterion can be used by itself or in conjunction with other criteria at a TDP. If the trigger assigned criterion is unconditional at a TDP, then it is used by itself - no other DP criterion needs to be satisfied at the TDP before informing the SCF that the TDP was encountered. If the trigger assigned criterion is conditional at a TDP, then it is used in combination with other criteria at the TDP - all of the other DP criteria in the combination need to be satisfied before informing the SCF that the TDP was encountered.

Applies at all DPs (all DPs can be provisioned as TDPs).

2) *Class of Service* - This is either a (i) customer class of service, (ii) trunk class of service, or (iii) private facility class of service; (i) is a code that identifies all attributes of a line that require distinctive call processing treatment (e.g. for party lines and coin lines), (ii) is a code that identifies attributes of a trunk group such as type of signalling used, and (iii) is a code that identifies attributes of a private trunk group such as type of signalling used and flash repeat capability.

Originating access (user / network) class of service is available at the Origination_Attempt DP and could be applicable at any of the originating DPs. Terminating access (user / network) class of service is available at the Termination_Attempt DP and could be applicable at any of the terminating DPs.

3) *Specific B-channel identifier* - An identifier of the specific B-channel on an ISDN interface from which a call attempt has originated or to which a call attempt is to be terminated.

A-party B-channel identifier is available at the Origination_Attempt DP for a party served by an ISDN interface only and could be applicable all originating DPs. B-party B-channel identifier is available during the Select_Facility PIC after an idle terminating facility has been selected for a party served by an ISDN interface only and could be applicable at the Facility_Selected_and_Available, T_No_Answer, T_Answer, T_Mid_Call, T_Suspended, T_Re_Answer and T_Disconnect DPs and at the T_Abandon DP (only after an idle terminating facility has been selected).

4) *Specific digit strings* - A string of digits that has to match collected digit strings for numbering plans in which a variable number of digits are to be collected. It could be zero or more digits (e.g. to trigger on "off-hook delay").

   The string of digits should be consistent with the structure of the dialling plan and should be administrable. For example, the network provider may specify the first N digits where N is consistent with the structure of the ITU-Recommendation E.164 [13] numbering plan, or any other appropriate numbering plan.

   Collected digit strings can be available at the Origination_Attempt DP for a party served by an ISDN interface using en bloc sending and at the Collected_Info DP for a party served by a non-ISDN line. Since collected digit strings are not analysed until the Analyse_Information PIC (except to determine if a sufficient number of digits have been collected), this criterion could be applicable at the Analysed_Info DP and beyond. The Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed since not all SSP suppliers may retain this information for the duration of the call / attempt.

   - collected digit string can be available at the Origination_Attempt DP through ISUP signalling for an SS7 trunk.

   - collected digit string can be available at the Collected_Info DP for a party served by a conventional trunk (e.g. non-SS7), ISDN interface using overlap sending, and private facilities.

5) *Feature codes* (e.g. *XX, #) - A vertical service code, such as a "#" or a two-digit or three-digit code preceded by "*" or "11," that precedes any subsequent digit collection (e.g. according to the "normal numbering plan").

   Feature codes can be available at the Origination_Attempt DP for a party served by an ISDN interface using en bloc sending or through ISUP signalling for an SS7 trunk, and can be available at the Collected_Info DP for non-ISDN lines and private facilities. Since collected digit strings are not analysed until the Analyse_Information PIC (except to determine if sufficient information has been collected), this criterion could be applicable at the Analysed_Info DP and beyond. The Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed since not all SSP suppliers may retain this information for the duration of the call / attempt.

   Feature codes can be available at the Collected_Info DP for a party served by an ISDN interface using overlap sending.

6) *Prefixes* (e.g. 0+, 00+, 011, 01, 1+) - A string of digits that are not feature codes or access codes and which precede any subsequent digit collection (e.g. according to the "normal numbering plan").

   Prefixes can be available at the Origination_Attempt DP for a party served by an ISDN interface using en bloc sending, and can be available at the Collected_Info DP for non-ISDN lines, conventional trunks, and private facilities. Since collected prefix information is not analysed until the Analyse_Information PIC (except to determine if sufficient information has been collected), this criterion could be applicable at the Analysed_Info DP and beyond. The Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed since not all SSP suppliers may retain this information for the duration of the call / attempt.

   Prefixes can be available at the Collected_Info DP for a party served by an ISDN interface using overlap sending.

7) *Access codes* (e.g. 8+) for customized numbering plan - A string of digits in a customized numbering plan that matches access codes such as attendant access codes, access codes to escape to the public network, access codes to access a private facility, access codes to access a private network, and feature access codes.

   Access codes can be available at the Origination_Attempt DP for a party served by an ISDN interface using en bloc sending, and can be available at the Collected_Info DP for non-ISDN lines and private facilities. Since collected access codes are not analysed until the Analyse_Information PIC (except to determine if sufficient information has been collected), this criterion could be applicable at the Analysed_Info DP and beyond. The Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed since not all SSP suppliers may retain this information for the duration of the call / attempt.

   Access codes can be available at the Collected_Info DP for a party served by an ISDN interface using overlap sending.

8) *Specific abbreviated dialling strings* for customized numbering plan - An abbreviated called party number in a customized numbering plan that has to match collected address information.

   Abbreviated address information can be available at the Origination_Attempt DP for a party served by an ISDN interface using en bloc sending, and at the Collected_Info DP for a party served by a non-ISDN line or private facilities. Since collected address information is not analysed until the Analyse_Information PIC (except to determine if sufficient information has been collected), this criterion could be applicable at the Analysed_Info DP and beyond. The Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed since not all SSP suppliers may retain this information for the duration of the call / attempt.

   Specific abbreviated dialling strings can be available at the Collected_Info DP for a party served by an ISDN interface using overlap sending.

9) *Specific calling party number strings* - A string of digits that has to match the calling party number, which is a local, national, or international ITU-T Recommendation E.164 [13] number or a number in a customized numbering plan. If a call has been forwarded, the calling party number is the number of the original calling party.

   The calling party number is available at the Origination_Attempt DP in the originating BCSM and the Termination_Attempt DP in the terminating BCSM for a call originating from a non-ISDN line, ISDN interface, and can be available at the Origination_Attempt DP and the Termination_Attempt DP for SS7 trunks. This criterion could be applicable at all DPs.

10) *Specific called party number strings* - A string of digits that has to match the called party number, which is either a local, national, or international ITU-T Recommendation E.164 [13] number, or a number in a customized numbering plan; the latter is not supported by SS7 or conventional trunks. If a call has been forwarded, the called party number is the number of the party that the call is forwarded to.

    The called party number can be available at the Origination_Attempt DP for a party served by an ISDN interface using en bloc sending or for an SS7 trunk, and can be available at the Collected_Info DP otherwise. Since collected address information is not analysed until the Analyse_Information PIC (except to determine if sufficient information has been collected), this criteria could be applicable at the Analysed_Info DP and beyond, and at all terminating DPs. In the originating BCSM, the Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed. No specific proposals are made for the DPs in the terminating BCSM.

11) *Nature of address* (e.g. Subscriber Significant Number, National Significant Number, International Number) - An indicator of whether the called party number is a private, local (or subscriber), national, or international number.

    The nature of address is available at the Analysed_Info DP. This criterion could be applicable at the Analysed_Info DP and beyond. The Analysed_Info DP [mandatory] and all those originating DPs that may be encountered after Analysed_Info [optional] are proposed since not all SSP suppliers may retain this information for the duration of the call / attempt.

12) *Bearer capability* - An indicator of the bearer capability as defined in ITU-T Recommendation Q.1228 [7].

    The bearer capability information is available at the Origination_Attempt DP. This criterion could be applicable at all DPs.

13) *Feature activation / indication* (unconditional / conditional on specific feature patterns) - In a local exchange only, a feature activation / indication on an ISDN interface or that is detected at the Mid_Call DP (e.g. "hook-flash," #, etc.) for ISDN and non-ISDN lines that can be sent in conjunction with or preceding other address / digit collection.

    A feature activation / indication can be available at all DPs in the originating BCSM for a party served by an ISDN interface, and can be available at the O_Mid_Call DP in the originating BCSM for a party served by a non-ISDN line. A feature activation / indication can be available at the T_No_Answer, T_Answer, T_Mid_Call, T_Suspended, T_Re_Answer, T_Disconnect and T_Abandon DPs in the terminating BCSM for a party served by an ISDN interface, and can be available at the T_Mid_Call DP in the terminating BCSM for a party served by a non-ISDN line. Since collected feature activation information is not acted upon before the Analyse_Information PIC in the originating BCSM and before the T_Alerting PIC in the terminating BCSM, this criterion could be applicable at the Analysed_Info DP and beyond, and at the following terminating DPs: T_No_Answer, T_Answer, T_Mid_Call, T_Suspended, T_Re_Answer, T_Disconnect and T_Abandon.

14) *Facility information* (unconditional / conditional on specific facility information patterns) - A match on the Facility Information Element contained in a signalling message as defined in DSS1 and ISUP.

    Applicable DPs can be determined by mapping signalling messages to the BCSM (see subclause 4.2.2 and ITU-T Recommendation Q.1229 (Bibliography), Appendix II) and are for further study.

15) *Cause* (unconditional / conditional on specific cause patterns) - A match on the cause IE contained in a signalling message as defined in DSS1 and ISUP or an indicator of the cause of specific events of interest. Further study is required to identify the cause values needed as DP criteria for IN CS2 services from the complete list of cause values specified in ITU-T Recommendation Q.1228 [7].

    Route selection failure information is available at the Route_Select_Failure DP, busy cause information is available at the O_Called_Party_Busy and T_Busy DPs, and release cause information is available at the O_Disconnect, O_Abandon, T_Disconnect and T_Abandon DPs. This criteria is applicable at the identified DPs.

16) Specific value of USIServiceIndicator - A value that identifies an IN service.

DP criteria assignment to a TDP is dependent on the information available at that TDP and the information available at a TDP is described in subclause 4.2.2.

The following two tables (table 4.3 and table 4.4) denote applicability of DP criteria to all the DPs.

The entries in the table can be:

- Customer Based;
- Trunk group Based;
- Private Facility Based;
- Office Based.

The DPs in the tables are abbreviated as follows:

OA = Origination_Attempt	TA = Termination_Attempt
OAA = Origination_Attempt_Authorized	TAA = Termination_Attempt_Authorized
CI = Collected_Info	
AI = Analysed_Info	
RSF = Route_Select_Failure	
OCPB = O_Called_Party_Busy	TB = T_Busy
	FSA = Facility_Selected_and_Available
ONA = O_No_Answer	TNA = T_No_Answer
OAns = O_Answer	TAns = T_Answer
OMC = O_Mid_Call	TMC = T_Mid_Call
OS = O_Suspended	TS = T_Suspended
ORA = O_Re_Answer	TRA = T_Re_Answer
OD = O_Disconnect	TD = T_Disconnect
OAb = O_Abandon	Tab = T_Abandon

Table 4.3: Originating DP Criteria

	Originating DP												
DP Criteria	OA	OAA	CI	AI	RSF	OCPB	ONA	OAns	OMC	OS	ORA	OD	OAb
Trigger Assigned	X	X	X	X	X	X	X	X	X	X	X	X	X
Class of Service	X	O	O	O	O	O	O	O	O	O	O	O	O
Specific Calling Party Number (note 4)	X	O	O	O	O	O	O	O	O	O	O	O	O
Bearer Capability (note 5)	X	O	O	O	O	O	O	O	O	O	O	O	O
Specific B-channel Identifier	O	O	O	O	O	O	O	O	O	O	O	O	O
Specific Digit String (note 1)	-	-	X	X	O	O	O	O	O	O	O	O	O
Feature Code (note 1)	-	-	X	X	O	O	O	O	O	O	O	O	O
Prefixes (note 1)	-	-	X	X	O	O	O	O	O	O	O	O	O
Access Codes (note 1)	-	-	X	X	O	O	O	O	O	O	O	O	O
Called Party Number (note 1)	-	-	X	X	O	O	O	O	O	O	O	O	O
Specific abbreviated dialling string (note 1)	-	-	-	X	O	O	O	O	O	O	O	O	O
Nature of Address	-	-	-	X	O	O	O	O	O	O	O	O	O
Feature Activation (note 3)	-	-	-	X	X	X	X	X	X	X	X	X	X
Facility information (note 2)	-	-	-	X	-	-	-	X	X	-	-	-	-
Cause	-	-	-	-	X	X	-	-	-	-	-	X	X
USIServiceIndic.	X	O	O	O	O	O	O	O	O	O	O	O	O

X: Applicable **-: Not Applicable** **O: Optional**

NOTE 1: Same type of trigger requiring analysis of a specific number of received digits. The analysis may be based on the complete number of received digits or may be based on a predefined number of digits starting from the most significant digit of the received information.

NOTE 2: A match on the facility information element contained in a signalling message as defined in DSS1 and ISUP.

NOTE 3: In a local exchange only. The BCSM has to analyse (if facility is allowed, stored as Class of Service attribute) the received information and has to initiate an IN trigger if required. A feature activation / indication can be available at all DPs in the originating BCSM for a party served by an ISDN interface and can be available at the O_Mid_Call DP in the originating BCSM for a party served by a non-ISDN line. A feature activation / indication can be available at the T_No_Answer, T_Answer, T_Mid_Call, T_Suspended, T_Re_Answer, T_Disconnect and T_Abandon DPs in the terminating BCSM for a party served by an ISDN interface and can be available at the T_Mid_Call DP in the terminating BCSM for a party served by a non-ISDN line.

NOTE 4: The analysis shall not be based on the complete calling party number, but rather on a predefined number of digits, starting from the most significant digit of the calling party number.

NOTE 5: Interpretation of bearer capability as optional for all DPs other than Origination_Attempt needs further clarification (e.g. Origination_Attempt DP mandatory means Termination_Attempt DP mandatory). Further, B-channel selection does not appear as a DP-criterion in the table because specific selection of B-channel by the user id for further study: the network may override user selection of B-channel to be used.

Table 4.4: Terminating DP Criteria

	Terminating DP											
DP Criteria	TA	TAA		TB	FSA	TNA	TAns	TMC	TS	TRA	TD	Tab
Trigger Assigned	X	X		X	X	X	X	X	X	X	X	X
Class of Service	X	O		O	O	O	O	O	O	O	O	O
Specific Calling Party Number (note 4)	X	O		O	O	O	O	O	O	O	O	O
Bearer Capability (note 5)	O	O		O	O	O	O	O	O	O	O	O
Specific B-channel Identifier	-	-		-	O	O	O	O	O	O	O	O
Specific Digit String (note 1)	-	-		-	-	-	-	-	-	-	-	-
Feature Code (note 1)	-	-		-	-	-	-	-	-	-	-	-
Prefixes (note 1)	-	-		-	-	-	-	-	-	-	-	-
Access Codes (note 1)	-	-		-	-	-	-	-	-	-	-	-
Called Party Number (note 1)	-	-		-	-	-	-	-	-	-	-	-
Specific abbreviated dialling string (note 1)	-	-		-	-	-	-	-	-	-	-	-
Nature of Address	-	-		-	-	-	-	-	-	-	-	-
Feature Activation (note 3)	-	-		-	-	X	X	X	X	X	X	X
Facility Information (note 2)	-	-		-	-	-	X	X	-	-	-	-
Cause	-	-		X	-	-	-	-	-	-	X	X
USIServiceIndicator	X	O		O	O	O	O	O	O	O	O	O

X: Applicable
-: Not Applicable
O: Optional

NOTE 1: Same type of trigger requiring analysis of a specific number of received digits. The analysis may be based on the complete number of received digits or may be based on a predefined number of digits starting from the most significant digit of the received information.

NOTE 2: A match on the facility information element contained in a signalling message as defined in DSS1 and ISUP.

NOTE 3: In a local exchange only. The BCSM has to analyse (if facility is allowed, stored as Class of Service attribute) the received information and has to initiate an IN trigger if required. A feature activation / indication can be available at all DPs in the originating BCSM for a party served by an ISDN interface and can be available at the O_Mid_Call DP in the originating BCSM for a party served by a non-ISDN line. A feature activation / indication can be available at the T_No_Answer, T_Answer, T_Mid_Call, T_Suspended, T_Re_Answer, T_Disconnect and T_Abandon DPs in the terminating BCSM for a party served by an ISDN interface and can be available at the T_Mid_Call DP in the terminating BCSM for a party served by a non-ISDN line.

NOTE 4: The analysis shall not be based on the complete calling party number, but rather on a predefined number of digits, starting from the most significant digit of the calling party number.

NOTE 5: Interpretation of bearer capability as optional for all DPs other than Origination_Attempt needs further clarification (e.g. Origination_Attempt DP mandatory means Termination_Attempt DP mandatory). Further, B-channel selection does not appear as a DP-criterion in the table because specific selection of B-channel by the user id for further study: the network may override user selection of B-channel to be used.

If a criterion is marked with an "X" for a Detection Point, then this means that a conditional TDP which is armed at the Detection Point may require the criteria as listed in the table to be satisfied before informing the SCF that the TDP was encountered. E.g. a conditional TDP at the Origination_Attempt DP may require the class of service criterion to be satisfied before the SCF is informed that the TDP was encountered.

If a criterion is marked with an "O" for a Detection Point, then this means that it is implementation dependent if the criteria specific information is still present at that DP because not all suppliers may retain this information for the duration of the call / attempt. If the information is still present, the treatment is the same as a criterion marked with an "X".

The trigger item is defined as a single set of DP criteria and the associated information that an SSF/CCF uses to determine if the criterion is met and how to process the trigger. The trigger item consists of DP criteria and the SCF routeing information. The trigger items are assigned to users by management process. An SSF should use the SCF routeing information to format and route the messages to the appropriate SCF application. The SCF may use existing MTP/SCCP capabilities to route to the SCF.

4.2.7 Trigger types and trigger precedence

Trigger Types as specified in subclause 4.2.7 of ITU-T Recommendation Q.1224 [6] are not supported.

Guidelines for trigger criteria priorities and combinations are the same as specified in EN 300 374-1 [1] annex C subclauses C.2.3 and C.2.4 which is repeated below. Note that the text of the present subclause is purely informative.

Trigger criteria combinations

A particular conditional TDP may require a combination of the applicable criteria to be checked before informing the SCF that the TDP was encountered.

Criteria may be combined using the:

- AND function (e.g. at Analysed_Information DP, initiate an SCF enquiry if Class of Service = international call barred AND Nature of Address = international);
- OR function (e.g. at Analysed_Information DP, initiate an SCF enquiry if Called Party Number = 831 or Called Party Number = 836);
- NOT function (e.g. at Analysed_Information DP, initiate an SCF enquiry if Called Party Number is NOT = 831).

The criteria combinations to be checked for a particular TDP are to be specified by means of management procedures applicable for the CCF/SSF.

Trigger criteria priorities

Multiple TDP-Rs may be armed at the same DP, each TDP-R being either an unconditional or a conditional TDP. Each TDP-R will have an associated set of criteria (i.e. conditions specific to the particular TDP-R that shall be met before the SCF is informed that the TDP is encountered). The priority of the TDP-Rs at a DP is to be specified by means of management procedures applicable for the CCF/SSF.

During the processing of TDP-Rs at a DP, the SSF has to check the set of criteria associated with each TDP-R in descending order of priority until either the set of criteria for a particular TDP-R is met (resulting in informing the SCF) or all sets of criteria have been checked and none has been met.

4.2.8 DP processing

Text in subclause 4.2.8 of ITU-T Recommendation Q.1224 [6] shall be followed with the exception that TDP-N shall not be supported.

In addition to ITU-T Recommendation Q.1224 [6] it has to be clarified that:

- encountering of a TDP-R (i.e. sending of InitialDP IF from the SSF to the SCF) will also lead to a control relationship even though no EDP-Rs are armed;
- encountering of the last EDP-R within a CSA maintains the existing control relationship even though no additional EDP-Rs are armed.

When call processing is resumed the control relationship will:

- continue as a control relationship if at least one EDP-R is armed for at least one Call Segment of a Call Segment Association;
- continue as a monitor relationship if there are no EDP-Rs armed but at least one EDP-N armed;
- terminate the relationship if there are no EDPs armed.

The text below is taken from subclause 4.2.8 in ITU-T Recommendation Q.1224 [6] for highlighting the difference between control relationship and monitor relationship:

A control relationship persists as long as there is at least one EDP-R armed for at least one call segment of a call segment association. A control relationship terminates if there are no more EDPs armed or the call clears. During a control relationship, EDPs may be dynamically disarmed by the SCF, or are disarmed by the SSF as they are encountered and reported to the SCF, or when the call clears (for details refer to 4.2.5.2).

Single point of control ensures that only one service logic exists within the control relationship.

Single point of control is only guaranteed within a Call Segment Association.

A control relationship changes to a monitor relationship if there are no more EDP-Rs armed and one EDP-N is armed. A monitor relationship terminates if there are no more EDP-Ns armed or the call clears. During a monitor relationship, EDP-Ns are disarmed by the SSF as they are encountered and reported to the SCF, or when the call clears (for details refer to 4.2.5.2).

4.2.9 Out-Channel Call-Related User Interaction (OCCRUI)

The provisions of subclause 4.2.9 in ITU-T Recommendation Q.1224 [6] shall be followed with the exception that there is no support for DP specific information flows.

4.3 IN-switching manager (IN-SM)

The provisions of subclause 4.3 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.3.1 IN-switching state model (IN-SSM)

The provisions of subclause 4.3.1 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.3.2 IN-SM core capabilities for Call Party Handling

The provisions of subclause 4.3.2 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.3.3 The Connection View State (CVS) Approach

The provisions of subclause 4.3.3 in ITU-T Recommendation Q.1224 [6] shall be followed with following exceptions:

- The example in subclause 4.3.3.6 in ITU-T Recommendation Q.1224 [6] is not valid for the present document.
- The Reconnect operation mentioned in subclauses 4.3.3.7 and 4.3.3.8 is not valid for the present document. Supported information flows are listed in subclause 4.1.5 of EN 301 140-1 [10].
- Subclause 4.3.3.7 in ITU-T Recommendation Q.1224 [6] shall not be followed, it is replaced by annex A of EN 301 140-1 [10].

4.3.4 The hybrid approach

The provisions of subclause 4.3.4 of ITU-T Recommendation Q.1224 [6] are not part of the present document.

4.3.5 IN-SSM EDPs

The provisions of subclause 4.3.5 of ITU-T Recommendation Q.1224 [6] shall be followed.

4.3.6 SSF resource control

The provisions of subclause 4.3.6 of ITU-T Recommendation Q.1224 [6] shall be followed.

4.3.6.1 SSF Resource Control for announcements and digit collection

The provisions of subclause 4.3.6.1 of ITU-T Recommendation Q.1224 [6] shall be followed with the addition that SRF connections may also be established to a leg and not only to a CP.

Additional restrictions to ITU-T Recommendation Q.1224 [6] are mentioned in subclause 12.5.2 of EN 301 140-1 [10].

4.4 Feature interactions manager (FIM)/call manager (CM)

The provisions of subclause 4.4 in ITU-T Recommendation Q.1224 [6] shall be followed except that TDP-N is not supported.

4.5 Relationship of SSF/CCF model components

The provisions of subclause 4.5 in ITU-T Recommendation Q.1224 [6] shall be followed.

4.6 Relationship of SSF/CCF to SCF

The provisions of subclause 4.5 in ITU-T Recommendation Q.1224 [6] shall be followed.

5 Specialized Resource Function (SRF) model

The provisions of clause 5 in ITU-T Recommendation Q.1224 [6] shall be followed.

6 Service Control Function (SCF) model

The provisions of clause 6 in ITU-T Recommendation Q.1224 [6] shall be followed.

7 Service Data Function (SDF) model

The provisions of clause 7 in ITU-T Recommendation Q.1224 [6] shall be followed.

8 Call Unrelated Service Function (CUSF) model

8.1 General

The provisions of subclause 8.1 in ITU-T Recommendation Q.1224 [6] shall be followed.

8.2 Basic non-call manager (BNCM)

The provisions of subclause 8.2 in ITU-T Recommendation Q.1224 [6] shall be followed.

8.2.1 BCUSM

The provisions of subclause 8.2.1 in ITU-T Recommendation Q.1224 [6] shall be followed.

8.2.2 BCUSM description for CS2

The provisions of subclause 8.2.2 in ITU-T Recommendation Q.1224 [6] shall be followed.

8.2.3 Transition for BCUSM

The provisions of subclause 8.2.3 in ITU-T Recommendation Q.1224 [6] shall be followed.

8.2.4 BCUSM DP criteria

As for the CS2 BCUSM, the DP criteria implies a check on 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 CS2.

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):

- Customer based;
- Trunk group based;
- Private facility based;
- Office based.

Table 8.1

	DPs	
DP criteria	ActivationReceived AndAuthorized	ComponentReceived
Trigger Assigned	X	X
ITU-T ISDN supplementary services operation codes (note 1)	X	O
Regional / Network operator specific ISDN supplementary services operation codes (note 2)	X	O
USIServiceIndicator	X	O
X Applicable **O Optional (the meaning of "X" and "O" is the same as for the BCSM)**		
NOTE 1: The total number of the codes does not exceed the number of currently defined ISDN supplementary services, and it should be noted that only IN CS2 relevant parts will be used (e.g. Call Forwarding Activation, etc.), and the exhaustive list of the codes is desirable to be defined in terms of the IN CS2 benchmark services / service features point of view. NOTE 2: The total number of the codes is regional or network operator specific.		

8.2.5 Call-Unrelated User Interaction (CUUI)

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 new IEs, respectively STUI in the "SCF-to-User" direction and UTSI in the "User to SCF" direction. These IEs are composed of two sub-IEs which are USIServiceIndicator and USIInformation. The first IE identifies the IN Service Logic invoked while, the second carries useful information between the User and the Service Logic.

In the "SCF-to-User" direction, once the CUSF receives an STUI IE from the SCF within the sendSTUI IF, it forwards it to the appropriate 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 CUUI mechanism is more complicated. In order to define how the CUSF decides whether it forwards the CUUI information it receives from a User to the succeeding exchange or it passes it to a specific IN service, it is necessary to distinguish two cases:

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

- The CUUI information is additional information. In this case, it is only optional information.

The ServiceIndicator value is indicated by the User or by the Service Logic:

- If the SCF has initiated the UTSI/STUI dialogue, the User sets the ServiceIndicator value of the UTSI IE to the ServiceIndicator value of the initial STUI IE. This scenario corresponds to the first case.

If the user sends an UTSI without having previously received an STUI IE from the SCF, then it initializes the ServiceIndicator value of the UTSI IE with an predefined value. This scenario corresponds to the second case.

8.2.5.1 First case: the CUUI information is considered as a "notification previously requested by the SCF"

In this case, the CUSF communicates with the SCF during a pre-existing SCF-CUSF relationship. Both SCF and CUSF behaviour can be described as above:

- By means of an information flow, independent from the BCUSM processing, one SCF tells the CUSF with the requestReportUTSI IF to report to it all the UTSI Information Elements with a given ServiceIndicator value.

- Then, once it receives an UTSI IE, the CUSF compares the ServiceIndicator value of this IE with the previously indicated ServiceIndicator value. If they coincide, then the CUSF reports the UTSI IE to the SCF with the reportUTSI information flows.

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 IE 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).

8.2.5.2 Second case: the CUUI information is additional, optional information

The CUUI information has no impact on the usual DP processing. The UTSI IE is only an optional parameter that the CUSF introduces in the following information flow after analysing the corresponding ServiceIndicator value to make sure that the received UTSI IE is targeted to this particular Service Logic.

InitialAssociationDP.

The CUSF checks if the ServiceIndicator value of the UTSI coincides with the ServiceIndicator value contained within the Service related data table.

NOTE: The STUI/UTSI IE 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).

8.2.5.3 Synthesis

The table and the SDL diagram beyond summarize the proposal.

Table 8.2

Scenario	CUUI FSM	Service Indicator indicated by the User	Service Indicator value of reference	IF sent to the SCF
STUI/UTSI dialogue	Monitoring UTSI IE	Indicated in the STUI IE Dynamic	Stored in the data table associated with the CUSF USI FSM	Special IF to define
UTSI = additional information	Idle	Predefined	Explicitly indicated in the IN related data table of the IN service Static in the CUSF	InitialAssociation DP IF

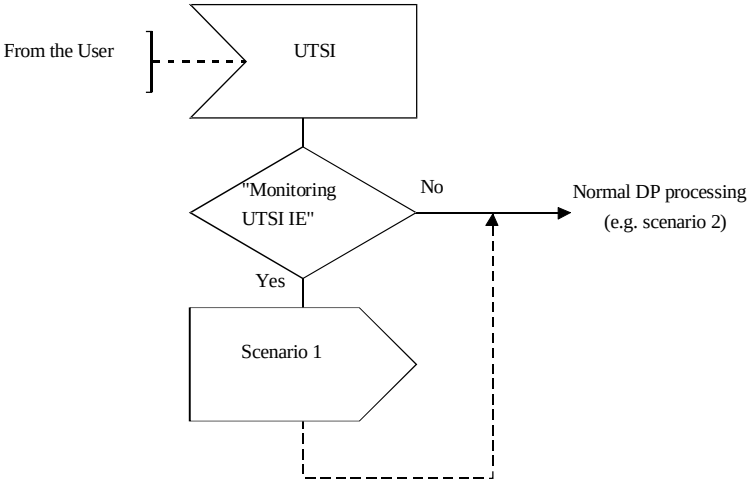


Figure 8.1

8.3 Description of Relationship Model

The provisions of subclause 8.3 in ITU-T Recommendation Q.1224 [6] shall be followed.

9 Service Management Function (SMF) Model

The provisions of clause 9 in ITU-T Recommendation Q.1224 [6] shall be followed.

10 Mapping of the global functional plane to the distributed functional plane

The provisions of clause 10 in ITU-T Recommendation Q.1224 [6] shall be followed.

11 Information flow diagrams and distributed service logic

The provisions of clause 11 in ITU-T Recommendation Q.1224 [6] shall be followed with following exceptions:

- only information flows supported in EN 301 140-1 [10] are supported;
- subclause 11.5.2 "Distributed service logic for SSF" in ITU-T Recommendation Q.1224 [6] is not part of the present document; refer to SDLs specified in EN 301 140-1 [10] for valid SDL diagrams;
- subclause 11.5.3 "Distributed service logic for assist / handoff SSF" in ITU-T Recommendation Q.1224 [6] is not part of the present document; refer to SDLs specified in EN 301 140-1 [10] for valid SDL diagrams;
- subclause 11.5.5 "Distributed service logic for SCF" in ITU-T Recommendation Q.1224 [6] is part of the present document as informative text only. Note that information flows between SCF and CUSF are not valid for the present document and that only information flows supported by EN 301 140-1 [10] are valid for the present document;
- subclause 11.5.7 "Distributed service logic for CUSF" in ITU-T Recommendation Q.1224 [6] is not part of the present document.

12 Relationships between FEs

Refer to EN 301 140-1 [10] for detailed description of relationships between IN FEs.

Annex A (normative): Applicability of annexes and appendixes of ITU-T Recommendation Q.1224

The provision of annexes A to D and Appendix 1 and 2 of ITU-T Recommendation Q.1224 [6] are not applicable to the present document.

Annex B (informative): Charging scenarios supported by core INAP

B.1 Introduction

This annex provides information on how the different charging capabilities in INAP CS2 may be used. Networks may support different or additional charging capabilities then listed in this annex.

With the introduction of IN, the charging as performed by the basic call process has to be extended. With IN, charging processes can be activated in both SCPs and SSPs. When for an IN call the charging processes in the SCP have to interwork with the charging processes in the SSP and the PSTN, specific charging operations have to be transferred via the INAP. This annex describes the IN charging requirements from an INAP point of view. First some terminology concerning charging processes and charging capabilities is listed, followed by particular charging scenarios for which the INAP requirements are listed. Via the information flows and information elements, the corresponding charging operations for the INAP are defined.

B.2 Terminology

Because there is already an existing definition of the terms Charge Determination and Charge Generation within ES 201 296 [14] which does not cover all aspects of IN Charge Determination and Generation in this annex the terms Charge Data Determination, Charge Data Generation and Charge Data Registration are used.

Charge Data Determination (DET):

All activities to determine charging or billing for an IN call. Following determinations may be distinguished:

- party(s) to be charged for the network access and/or IN service usage. Charge party can be the calling line or IN service subscriber or both;
- tariff- respectively level of charge;
- determining the items to be charged;
- method of charging the party(s) to be charged: type of charging/billing records, off-line or on-line.

NOTE: Different nodes (functions) may be involved in charge determination.

If determination of the previous elements is performed off-line then in that case only a call record is registered containing call- and service related data.

Charge Data Generation (GEN):

Time dependent generation of the correct charges. In case of off-line charging the data collection (e.g. time stamps, call duration).

Charge Data Registration (REG):

Registering the evaluated charges (on-line) and/or the collected charge data (off-line) into call records for providing them to a postprocessing centre or updating the charge meters or both.

Charge Output (OUT):

Output of charging data for further processing. Charging data can be output to magnetic tapes or data-links, on operator request or scheduled.

Off-line charging:

The usage and/or charge information of the call is recorded in the network (e.g. OLE, SSP or SCP). The calculation of the charge for that call and the billing is performed in an off-line process. The information recorded could also be used for other purposes by the network operator (e.g. accounting).

Off-line charging/billing/accounting process (OFC):

A FE which processes the call records retrieved from the other FE's (SSF, SCF, international exchange, LE) to prepare the bill for the subscriber or to support other accounting processes.

On-line charging:

In this case charging information during the call instance has to be calculated in real time. This further processing of charging information in real time could be for the support of the pay phone, AOC (advice of charge) or for charge metering or for credit limit supervision.

On-line Charge Information provision to the user access (ONC):

Provision of charge pulses or signalling information on the user/network interface during call instance (e.g. via ISDN: Advice of Charge (AOC)).

In the PSTN/PLMN it is in general regarded as subscriber feature.

B.3 Charging scenarios

In an IN structured network, the charging for services may be split between several parties. Each of the following scenarios shows a possible atomic charging configuration for one of the parties. Scenarios may be combined to give the total charging capabilities required for a service. The choice of scenario for each charged party is a network specific option.

Dependent on the location of Charge Data Determination, Charge Data Generation and Charge Data Registration different IN charging scenarios may be distinguished. In the following these atomic scenarios are listed.

For simplification the model 'SSP on transit level with incoming- and outgoing ISUP signalling and charging of the calling line is done at the originating local exchange (OLE)' is used. Of course the same principles apply if the SSP is located at an other level within the basic network.

There is no special distinction between on- and off-line charging made in the following because the scenarios may almost be the same for both methods.

The following table indicates the mapping of the references of part 1 with regard to the charging scenarios.

Table B.1:

Part 1 Reference	Charging Scenario
1.	A.1
2.1	B.5
2.2	B.2
2.3	B.1
2.4	B.1+B.3
3.2	A.2
4.1	B.4
4.2	B.1+B.4

B.3.1 Scenario A: Application of the Basic Network Charging Function (BNCF)

For call related IN services a basic network (PSTN/PLMN) may be used for accessing the IN. The charging for that access is usually done by the standard network charging functions (e.g. 'calling line').

In one case (**scenario A.1**), the charging is completely done by the existing charging mechanisms in the PSTN/ISDN, such as using the service access code to determine the tariff, and meters in the LE to count the charge pulses. For this mechanism, no INAP operations are required, as no charging functions are performed by the SSF, SCF or any other IN FE.

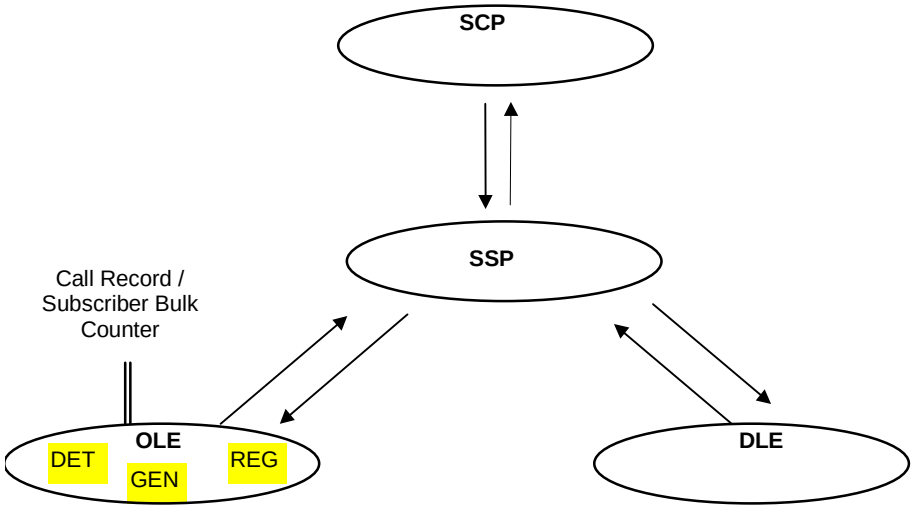


Figure B.1: Scenario A.1

In the other case case, the SCF has control of the charging information and instructs the SSF on the charging information to be sent by the SSF (**scenario A.2**).

In the LE, either a charge meter can be updated or a standard call record can be generated. There is no call record generated at the SSF or SCF.

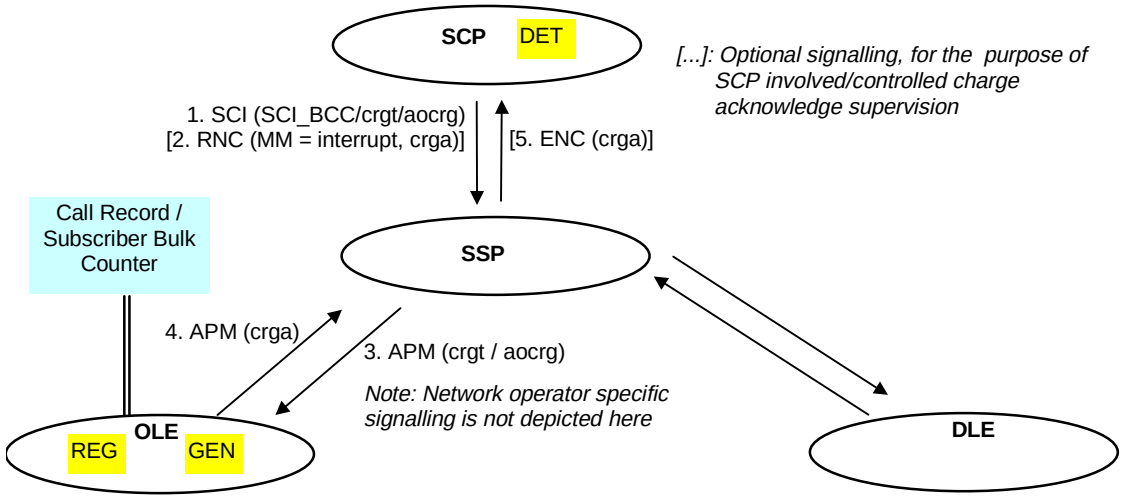


Figure B.2: Scenario A.2

If the SSF is a LE, the principles are the same, but the SSF-LE interface will be internal rather than by network signalling. The SCF needs not to know whether the SSP is a transit or a local exchange.

B.3.2 Scenario B: IN charging completely in the IN

In this scenario, the charging is done completely in the IN nodes. The PSTN will determine from e.g. the service access code, that no charge is to be raised, and all accounting will be performed at either the SSF or the SCF. The control of charging is always at the SCF, but call records may be registered at either the SSF or SCF.

In case call records are registered at the SSF charge data generation may be done completely at the SSF (**scenario B.1**) or at the SCF (**scenario B.2**) or at both the SSF and the SCF (**scenario B.3**). For scenario B.2 the SCF provides the complete charging record to the SSF. Data collection may be done at both components, e.g. collection of usual call related charge data at the SSF and collection of data which result on an user interactive dialogue or application of special service features at the SCF.

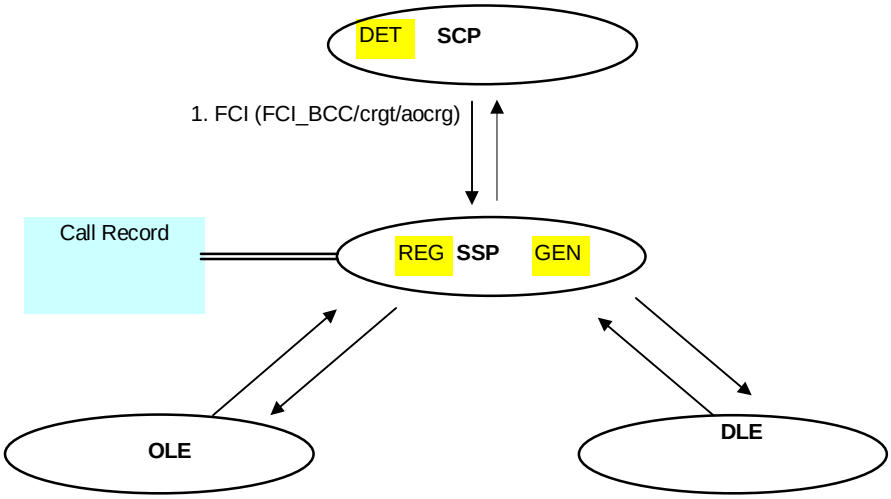


Figure B.3: Scenario B1

The same cases can be distinguished for the SCF registration. In this case charge data generation may be done completely at the SSF (**scenario B.4**) or at the SCF (**scenario B.5**).

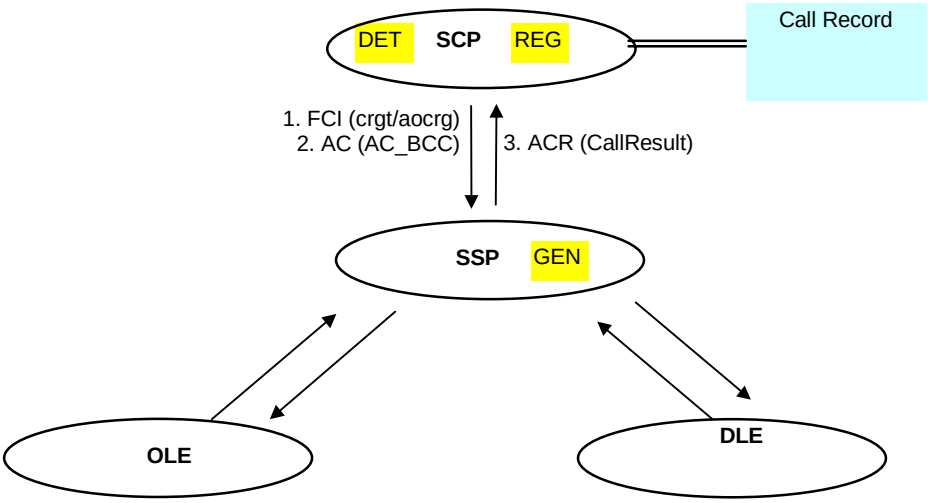


Figure B.4: Scenario B.4

B.4 On-line Charge Information provision to the user access (ONC)

With respect to the ONC function, some special aspects have to be considered. This function is always located at the local exchange (e.g. OLE) and usually closely related to the BNCF (scenario A).

If the ONC is completely handled in the PSTN (**scenario C.1**) no special charge information is provided from the IN for the feature. In general the same charges as used for scenarios A are displayed to the user's access without any additional IN intervention.

In the other case (**scenario C.2**) it relates to one of the charging scenario's 'B'.

ONC is shared between IN and PSTN/PLMN. In this case the SCF controls the charge information to be displayed to the subscriber directly.

Therefore the SCF instructs the SSF on charge information to be forwarded to the subscriber's display.

It is up to the Network Provider to specify details of the interworking, that means the mapping of this INAP/ISUP charging operations and parameters on the user/network interface signalling (e.g. DSS1).

B.5 Framework for the charging operations in INAP

Charging Scenarios

	DET	GEN	REG	Information to be transferred by INAP charging operations (examples)	INAP Charging Operations	Parameters
A.1	OLE	OLE	OLE	no	No	no
A.2	SCF	OLE	OLE	charge level / crgt / aocrg / crga	SCI [RNC, ENC]Note 1	SCI_BCC, legID, tariffMessage
B.1	SCF	SSF	SSF	party to charge / charge level / crgt	FCI	FCI_BCC, FCI_BCCcs2, tariff
B.2	SCF	SCF	SSF	party to charge / charge level / aocrg / item	FCI	FCI_BCC, FCI_BCCcs2, tariff
B.3	SCF	SSF, SCF	SSF	party to charge / charge level / crgt / aocrg / item	FCI	FCI_BCC, FCI_BCCcs2, tariff
B.4	SCF	SSF, [SCF] Note 3	SCF	party to charge / threshold /charge level / crgt / aocrg	AC, ACR, [FCI] Note 2	AC_BCC, partyToCharge, CallResult, [FCI_BCC, FCI_BCCcs2, tariff]
B.5	SCF	SCF	SCF	no	No	no

ONC Scenarios

C.1	OLE	OLE	OLE	no	No	no
C.2	SCF	OLE	[OLE] Note 4	charge level / crgt / aocrg / crga	SCI [RNC, ENC]Note 1	SCI_BCC, legID, tariffMessage,

NOTE 1: Optional, for the purpose of SCP involved/controlled charge acknowledge supervision.

NOTE 2: Is used for Tariff Data transfer.

NOTE 3: The SCF may add additional charges e.g. for service feature usage, special announcements.

NOTE 4: Registration of ONC-charges may be network operator specific and can be independent of the access-related charges.

NOTE:

- The SCI semantic: Charge related information to control the basic network charge process (e.g. the advice of charge information to be sent by the SSF).
- The FCI semantic: Charge related information to control the IN specific charge process (e.g an IN call record). Presently the party to charge is not explicitly indicated. It is assumed that also this operation is leg related. The FCI allows the provision of tariff information in addition to AC (see scenario B.4).
- The CS1 scenario 3.2 has been removed from the table because this scenario charge generation is not done by the SSF. Only in case of analogue signalling the CCF at the SSP has to generate pulses under special conditions. Instead of this scenario A.2 has been introduced.
- The CS1 scenario 2.4 has been removed from the table because this scenario is a combination of scenario's B.1 and B.3.

B.6 Interworking with other charge determination points

Complete SCP control

In this option SCF has control of the charging information and instructs SSF to monitor and intercept the charge related signalling message(s) received from a higher exchange (this may be e.g. other SSF-SCF instance or an international gateway). This implies, that Charge Data Determination functions are shared between higher exchange and SCP.

Based on criteria supplied by the SCF, the SSF will send this information to the SCF immediately after receipt of the appropriate message type. Subsequently, the SCF may use this information performing its charging control (use the received charging information in the call record generation or to adjust new charge rates/pulses/charging tariff information/add-on charging information to be sent to the SSF for further processing).

In this case the operation RNC has to be used for requesting the report and interception of charging events (via parameter monitorMode = Interrupted).

Receiving one of these messages the SSF will immediately forward it (without any processing) to the SCF via operation ENC. The SCF - the receiver of the charge messages - is responsible for acknowledging these charge messages. Otherwise the sender would possibly clear the whole call because of expiration of the supervision timer of the charging tariff information or add-on charging information. For this acknowledgement the SCI operation with parameter crga must be sent.

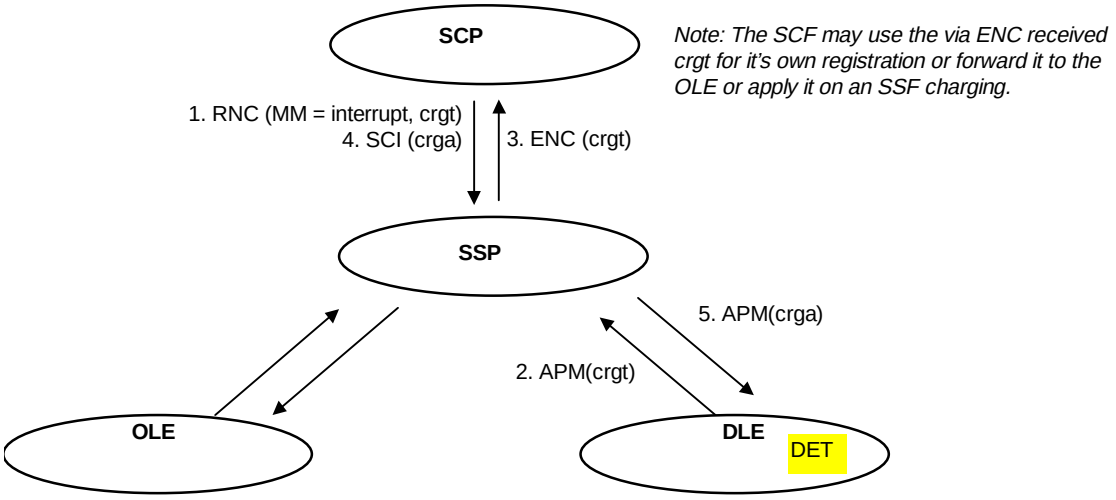


Figure B.5: Complete SCP control of crgt

SSP processing with SCP Monitoring

The SCF is not involved in Charge Determination and just monitors the charging events initiated from a higher exchange.

The operation **RNC** has to be used for requesting the report of charging events (via parameter *monitorMode* = *NotifyAndContinue*).

Receiving one of these messages (from B-side or an other IN service logic) the SSF will forward it to the SCF via operation **ENC** immediately. Processing of the charge messages is done as described below in section 'SSP processing without SCP Monitoring'. Acknowledgement of the charge messages is in the responsibility of the charging application which processes the charging tariff information or add-on charging information. The SCF is not responsible for acknowledging these charge messages.

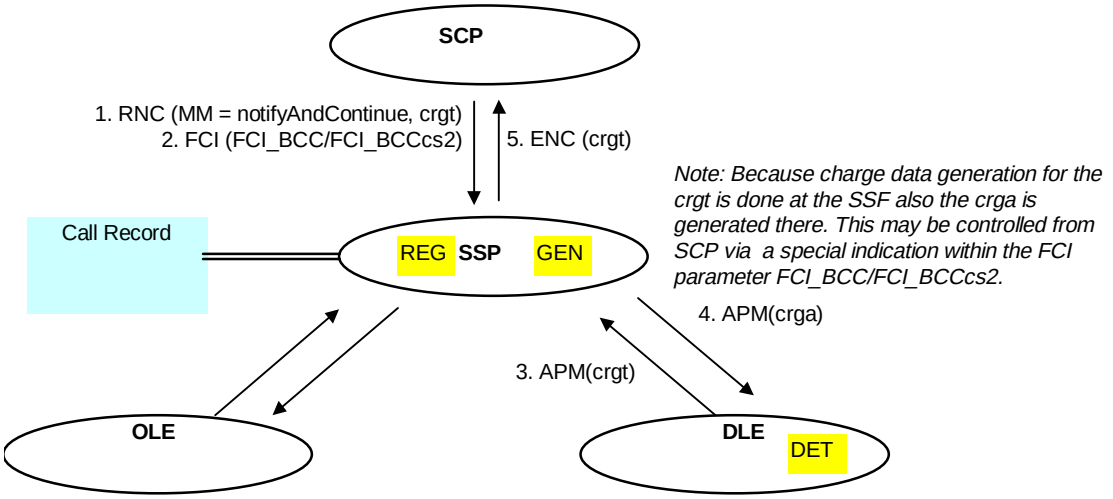


Figure B.6: Combination of direct processing of crgt in scenario B.1 with SCP Monitoring of crgt

SSP processing without SCP Monitoring

In this case the SCF has either:

- to instruct the SSF which charging application - non access related charging according to scenario B.1, B.3 or access related charging according to scenario A.2 - shall apply these tariffs; or
- the SSP decides it itself by means of it's own control data.

Acknowledgement of the charge messages is in the responsibility of the charging application which processes the charging tariff information or add-on charging information. The SCF is not responsible for acknowledging these charge messages.

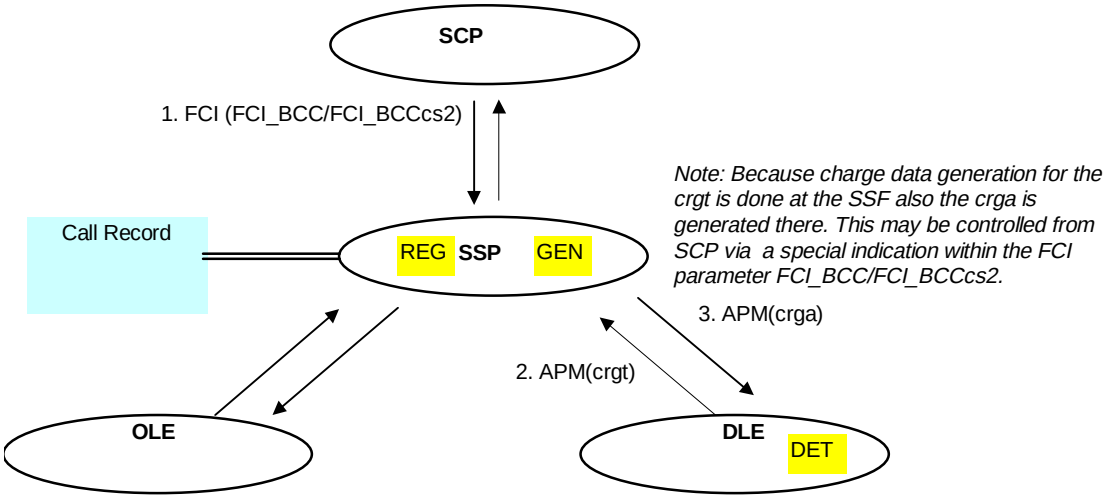


Figure B.7: Direct processing of crgt in scenario B.1

Annex C (informative): Implicit Disarming rules

Implicit EDP disarming rules are specified in the tables below for Originating BCSM and respectively Terminating BCSM. Each table specifies which EDP's should be disarmed (i.e. MonitorMode set to Transparent) if/when each EDP is encountered, irrespective of the EDP's MonitorMode (Transparent, NotifyAndContinue, or Request).

When EDP's armed with MonitorMode 'Request' (EDP-R's) are encountered, any implicit EDP disarming should take place before reporting the EDP and transiting the FSM for CS to the WFI state (if not already suspended in the WFI state).

If more than one BCSM is present in a single Call Segment and at least one of the BCSM's has encountered DP7/15 (O/T_Answer) then an originator release must be detected as a DP9/17 event (O/T_Disconnect).

NOTE: The rules are designed for use in a Single Point of Control configuration and may require further enhancements if they were to be used in a Multiple Points of Control configuration. Enhancements to these rules in order to cover all aspects of MPC will have to be catered for in the next IN- Capability Set.

Table C.1: O_BCSM: Implicit EDP Disarming Table

EDP Disarmed	1	2	3	4	5	6	7	8 C Leg	8 P Leg	9 C Leg	9 P Leg	10	19	20	24
EDP Encountered															
1	#														
2		#													
3			#												
4				#	#	#	#		#		#		#	#	#
5				#	#	#	#		#		#		#	#	#
6				#	#	#	#		#		#		#	#	#
7				X	X	X	#					X (note 2)	X		
8 Controlling Leg								# (note 1)							
8 Passive Leg									# (note 1)						
9 Controlling Leg	#	#	#					#		#		#			
9 Passive Leg				#	#	#	#		#		#		#	#	#
10	#	#	#					#		#		#			
19													#		
20														#	
24															#

Legend:
Represents IN CS-1 (1995) compliant SSF EDP disarming (e.g. leg is released, EDP is encountered).
X Represents the current understanding of IN CS-2 SSF Implicit Disarming of EDP.and forms the basis for CS3.
NOTE 1: Only the detected service code or the range to which the service code belongs is disarmed.
NOTE 2: O/T-Abandon DP is disarmed if it is the last armed DP and no other reports are pending, this allows the relationship to be closed.

Table C.2: T_BCSM: Implicit EDP Disarming Table

EDP Disarmed	12	13	14	15	16 C Leg	16 P Leg	17 C Leg	17 P Leg	18	21	25	26	27
EDP Encountered													
12	#												
13	#	#	#	#	#		#			#	#	#	#
14	#	#	#	#	#		#			#	#	#	#
15		X	X	#					X (note 2)			X	X
16 Controlling Leg					# (note 1)								
16 Passive Leg						# (note 1)							
17 Controlling Leg		#	#	#	#		#			#	#	#	#
17 Passive Leg	#					#		#	#				
18						#		#	#				
21										#			
25											#		
26												#	
27													#

Legend:
Represents IN CS-1 (1995) compliant SSF EDP disarming (e.g. leg is released, EDP is encountered).
X Represents the current understanding of IN CS-2 SSF Implicit Disarming of EDP.and forms the basis for CS3.
NOTE 1: Only the detected service code or the range to which the service code belongs is disarmed.
NOTE 2: O/T-Abandon DP is disarmed if it is the last armed DP and no other reports are pending, this allows the relationship to be closed.

Key to EDP's:

EDP1 - Origination_Attempt_Authorized

EDP2 - Collected_Information

EDP3 - Analysed_Information

EDP4 - Route_Select_Failure

EDP5 - O_Called_Party_Busy

EDP6 - O_No_Answer

EDP7 - O_Answer

EDP8 - O_Mid_Call

EDP9 - O_Disconnect

EDP10 - O_Abandon

EDP19 - O_Term_Seized

EDP20 - O_Suspend

EDP24 - O_Re-answer

EDP12 - Termination_Attempt_Authorized

EDP13 - T_Busy

EDP14 - T_No_Answer

EDP15 - T_Answer

EDP16 - T_Mid_Call

EDP17 - T_Disconnect

EDP18 - T_Abandon

EDP21 - T_Suspended

EDP25 - T_Re-answer

EDP26 - Facility_Selected_And_Available

EDP27 - Call_Accepted

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ITU-T Recommendation Q.1229: (Not yet publicly available).
- ITU-T Recommendation Q.1238.2: (Not yet publicly available).
- ETR 186-2: "Intelligent Network (IN); Interaction between IN Application Protocol (INAP) and Integrated Services Digital Network (ISDN) signalling protocols; Part 2: Switching signalling requirements for IN Capability Set 2 (CS2) service support in a Narrowband ISDN (N-ISDN) environment".
- ETS 300 008-1: "Integrated Services Digital Network (ISDN); Signalling System No.7; Message Transfer Part (MTP) to support international interconnection; Part 1: Protocol specification [ITU-T Recommendations Q.701 (1993), Q.702 (1988), Q.703 to Q.706 (1993), modified]".
- ETS 300 009-1: "Integrated Services Digital Network (ISDN); Signalling System No.7; Signalling Connection Control Part (SCCP) (connectionless and connection-oriented class 2) to support international interconnection; Part 1: Protocol specification [ITU-T Recommendations Q.711 to Q.714 and Q.716 (1993), modified]".
- ETS 300 121: "Integrated Services Digital Network (ISDN); Application of the ISDN User Part (ISUP) of CCITT Signalling System No.7 for international ISDN interconnections (ISUP version 1)".
- EN 300 196-1: "Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".
- ETS 300 287-1: "Integrated Services Digital Network (ISDN); Signalling System No.7; Transaction Capabilities (TC) version 2; Part 1: Protocol specification [ITU-T Recommendations Q.771 to Q.775 (1993), modified]".
- ETS 300 348: "Intelligent Network (IN); Physical plane for intelligent network Capability Set 1 (CS1) [ITU-T Recommendation Q.1215 (1993)]".
- EN 300 356-1: "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 3 for the international interface; Part 1: Basic services [ITU-T Recommendations Q.761 to Q.764 (1997), modified]".
- GTS GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification (GSM 04.08)".
- GTS GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification (GSM 09.02)".
- ISO 639 (1988): "Code for representation of names of languages".
- ISO 9545 (1989): "Information technology - Open Systems Interconnection -Application Layer structure".
- ITU-T Recommendation Q.71: "ISDN circuit mode switched bearer services".
- ITU-T Recommendation Q.700: "Introduction to CCITT Signalling System No.7".
- ITU-T Recommendation Q.710: "Signalling System No.7; Simplified MPT version for small systems".
- EN 301 070-1: "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 3 interactions with the Intelligent Network Application Part (INAP); Part 1: Protocol specification [ITU-T Recommendation Q.1600 (1997), modified]".
- ITU-T Recommendation Q.767: "Application of the ISDN user part of CCITT Signalling System No. 7 for international ISDN interconnections".
- ITU-T Recommendation Q.850: "Usage of cause and location in the digital subscriber signalling system no 1 and the signalling system no 7 ISDN user part".

- ITU-T Recommendation Q.1225: "Physical plane for Intelligent Network Capability Set 2".
- ITU-T Recommendation Q.1400: "Architecture framework for the development of signalling and OA&M protocols using OSI concepts".
- ITU-T Recommendation X.208: "Specification of Abstract Syntax Notation One (ASN.1)".
- ITU-T Recommendation X.209: "Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)".
- ITU-T Recommendation X.219: "Remote operations: Model, notation and service definition".
- ITU-T Recommendation X.229: "Remote operations: Protocol specification".
- ITU-T Recommendation X.252: (see note).
- ITU-T Recommendation X.500: "Information technology; Open Systems Interconnection; The directory: Overview of concepts, models, and services".
- ITU-T Recommendation X.501 | ISO/IEC 9594-2: "Information technology; Open Systems Interconnection; The directory: Models".
- ITU-T Recommendation X.509: "Information technology; Open Systems Interconnection; The directory: Authentication framework".
- ITU-T Recommendation X.511 (1993) | ISO/IEC 9594-3 (1993): "Information technology; Open Systems Interconnection; The directory: Abstract service definition".
- ITU-T Recommendation X.518 (11/93): "Information technology; Open Systems Interconnection; The directory: Procedures for distributed operation".
- ITU-T Recommendation X.519 | ISO/IEC 9594-5: "Information technology; Open Systems Interconnection; The directory: Protocol specifications".
- ITU-T Recommendation X.525 | ISO/IEC 9594-9: "Information technology; Open System Interconnection; The Directory: Replication".
- ITU-T Recommendation X.680 ASN.1: "Information technology; Abstract Syntax Notation One (ASN.1): Specification of basic notation".
- ITU-T Recommendation X.690: "Information technology; ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)".
- ITU-T Recommendation X.831: "Information technology - Open Systems Interconnection; Generic upper layers security: Security Exchange Service Element (SESE) service definition".
- ITU-T Recommendation X.832: "Information technology - Open Systems Interconnection; Generic upper layers security: Security Exchange Service Element (SESE) protocol specification".
- ITU-T Recommendation X.880 | ISO/IEC 9072-1: "Information technology; Remote operations: concepts, model and notation".

History

Document history				
V1.1.1	September 1998	Public Enquiry	PE 9903:	1998-09-18 to 1999-01-15
V1.1.2	August 1999	Vote	V 9946:	1999-08-31 to 1999-10-29