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SERIES Q: SWITCHING AND SIGNALLING
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Interface Recommendation for Intelligent Network Capability Set 4: SCF-SSF interface

ITU-T Recommendation Q.1248.2

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ITU-T Recommendation Q.1248.2

Interface Recommendation for Intelligent Network Capability Set 4: SCF-SSF interface

Summary

The Q.1248.x family of Recommendations defines the Intelligent Network (IN) Application Protocol for IN capability set 4 (IN CS-4). This family of Recommendations Q.1248.x defines the INAP for IN CS-4 based upon IN CS-2 ITU-T Q.1228 and Q.1224 (1997), and the general rules for INAP provided in ITU-T Q.1208, and is consistent with the scope of IN CS-4 as defined in ITU-T Q.1241.

Within the Q.124x series of Recommendations, ITU-T Q.1248.x family describes the protocol realizing the Q.1231 Distributed Functional Plane in a service and vendor implementation independent manner, as constrained by the capabilities of the embedded base of network technology.

This provides the flexibility to allocate distributed functionality into multiple physical network configurations and to evolve IN from IN CS-4 to some future CS-N.

This Recommendation belongs to the Q.1248.x family of Recommendations for IN capability set 4. It covers the SSF-SCF interface including the description of the aspects of the Functional Entities SSF and SCF which are relevant to this interface.

This Recommendation includes an electronic attachment containing Annex A, ASN.1 definitions.

Source

ITU-T Recommendation Q.1248.2 was prepared by ITU-T Study Group 11 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 July 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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

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

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

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation Q.1248.2

Interface Recommendation for Intelligent Network Capability Set 4: SCF-SSF interface¹

1 Scope

This Recommendation belongs to the Q.1248.x family of Recommendations for IN capability set 4. It specifies the protocol on the SSF-SCF interface and provides a description of the aspects of the SSF and SCF Functional Entities which are involved in the realization of this interface.

2 References

All ITU-T Recommendations and other references in this text are identified in ITU-T Q.1248.1.

3 Abbreviations and acronyms

All abbreviations and acronyms used in this text are defined in ITU-T Q.1248.1.

4 Relationships

4.1 SSF-CCF relationship

Call/service processing builds upon the current call process infrastructure of existing digital exchanges. It does so by using a generic model of existing call control functionality to process basic two-party calls, then adding service switching functionality to invoke and manage IN service logic. Once invoked, IN service logic is executed under the control of service control functionality, in conjunction with service data functionality. With this distributed approach to call/service processing, the existing call control functionality retains ultimate responsibility for the integrity of calls, as well as for the control of call processing resources.

The following call/service processing constraints apply:

- 1) Call control and service switching functionality are tightly coupled, thus the relationship between SSF and CCF is not standardized.
- 2) A call is either between two or more end users that are external to the network and addressable via a directory number or combination of directory number and bearer capability, or a call is between one or more end users and the network itself.
- 3) A call may be initiated by an end user, or by an SCF within the network on behalf of an end user. To supplement a call, IN service logic may either be invoked by an end user served by an IN exchange, or by the network on behalf of an end user.
- 4) A call may span multiple exchanges. As such, each exchange only controls the portion of the call in that exchange: call processing is functionally separated between exchanges. IN service logic invoked on IN exchanges in such an inter-exchange call is managed independently by each IN exchange.
- 5) Existing exchanges can be viewed as having two functionally separate sets of call processing logic that coordinate call processing activities to create and maintain a basic two-party call. This functional separation is provided between the originating portion of the call and the terminating portion of the call. This functional separation should be maintained in an IN exchange to allow IN service logic invoked on the originating portion of the call

¹ This Recommendation includes an electronic attachment containing Annex A, ASN.1 definitions.

- (i.e. on behalf of the calling party) to be managed independently of IN service logic invoked on the terminating portion of the call (i.e. on behalf of the called party).
- 6) It is desirable to allow multiple IN-supported service logic instances to be simultaneously active for a given end user. It is also recognized that non-IN service logic will continue to exist in the network. As such, service feature logic instances mechanisms should:
- i) determine which service logic to invoke for a given service request. This mechanism should select the appropriate IN-supported service logic or non-IN-supported service logic, and block the invocation of any other service logic for that particular service request;
 - ii) limit simultaneously active IN- and non-IN-supported service logic instances;
 - iii) ensure that simultaneously active IN-supported service logic instances adhere either to the single-ended, single point of control (SPC) restriction or to the single-ended, multiple points of control (MPC) capability as introduced with IN CS-4. For each half call a CS-4 compliant CCF/SSF may behave either according to SPC rules or MPC rules depending on trigger table information provided at IN service triggering.
- 7) The distributed approach and added complexity of call/service processing requires mechanisms for fault detection and recovery, allowing graceful termination of calls and appropriate treatments for end users.

4.2 SSF-SCF relationship

The SCF-SSF relationship is used for communication between an SCF and an SSF in the public network. This relationship, with the aid of possible other relationships (e.g. the SCF-SRF, SCF-SCF and SCF-SDF), provides a variety of services and service features. Details of service drivers for IN CS-4 can be found in ITU-T Q.1241.

A relationship between the SCF and SSF is established either as a result of the SSF sending a request for instruction to the SCF, or at the request of the SCF for initiation of a call or for some non-call-related reason.

A relationship between a SCF and a SSF is normally terminated at the request of the SCF. The SSF may also terminate the relationship, e.g. when no pending monitor requests prevails or in error cases.

A single SCF instance may have concurrent relationships with multiple SSF instances. A single SSF instance may have concurrent relationships with multiple SCF instances in the case where the IN CS-4 Multiple Points of Control applies to a half call instance. If Single Point of Control applies a single SSF instance it may only have a relationship with one SCF instance at a time for any given half-call instance. Note that this refers to control as opposed to monitor relationships.

It should be noted that the selection of an SRF is not always performed by the SCF. In some cases selection is performed by an SSF, for example, where assist/hand-off procedures are being used. For details regarding the relationship to the SRF see ITU-T Q.1248.3.

5 CCF Functional Model

5.1 Introduction

The Call Control Function (CCF) provides an abstraction of the part of a switch which implements basic call and connection control to establish communication paths for users, and to interconnect such communication paths.

Figure 1 depicts a functional decomposition of the CCF and its relationship to other components that are involved in call and service processing. Within the CCF, the Basic Call Control Entity is

responsible for the overall co-ordination of basic call processing. It interacts with the Bearer Control Entity that controls media resources.

The CCF and the media resources may reside in the same physical entity (e.g. traditional switching centre) or be implemented in two different physical nodes (e.g. see BICC architecture). This is not visible to IN service logic instances.

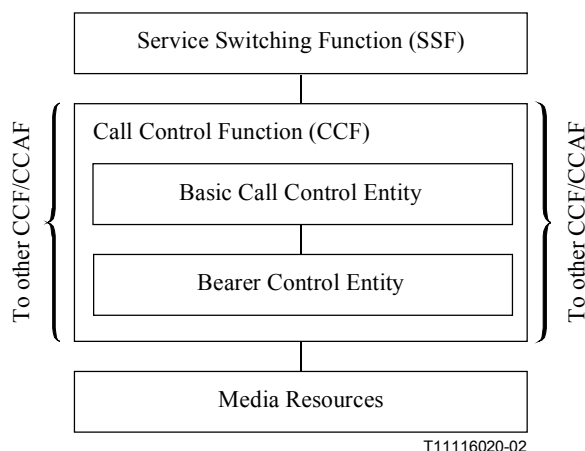


Figure 1/Q.1248.2 – Relationships between the CCF and other components

5.2 Basic Call Control Entity

5.2.1 Overview

5.2.1.1 Functional decomposition

The Basic Call Control Entity is responsible for the overall co-ordination of basic call processing in the CCF. As illustrated by Figure 2, the Basic Call Control Entity can be further modelled as being composed of a Basic Call Controller (BCC) and a set of Signalling Terminations (ST).

The Basic Call Controller manages a set of call processing state machines, which behaviour is described by the Basic Call State Model (BCSM). This model includes an originating half BCSM and a terminating half BCSM. This reflects the functional separation in the CCF model between the originating and terminating portions of calls that serve to isolate single-ended service logic instances related to the calling party from single-ended service logic instances related to the called party for the same call, i.e. the "half call" model approach.

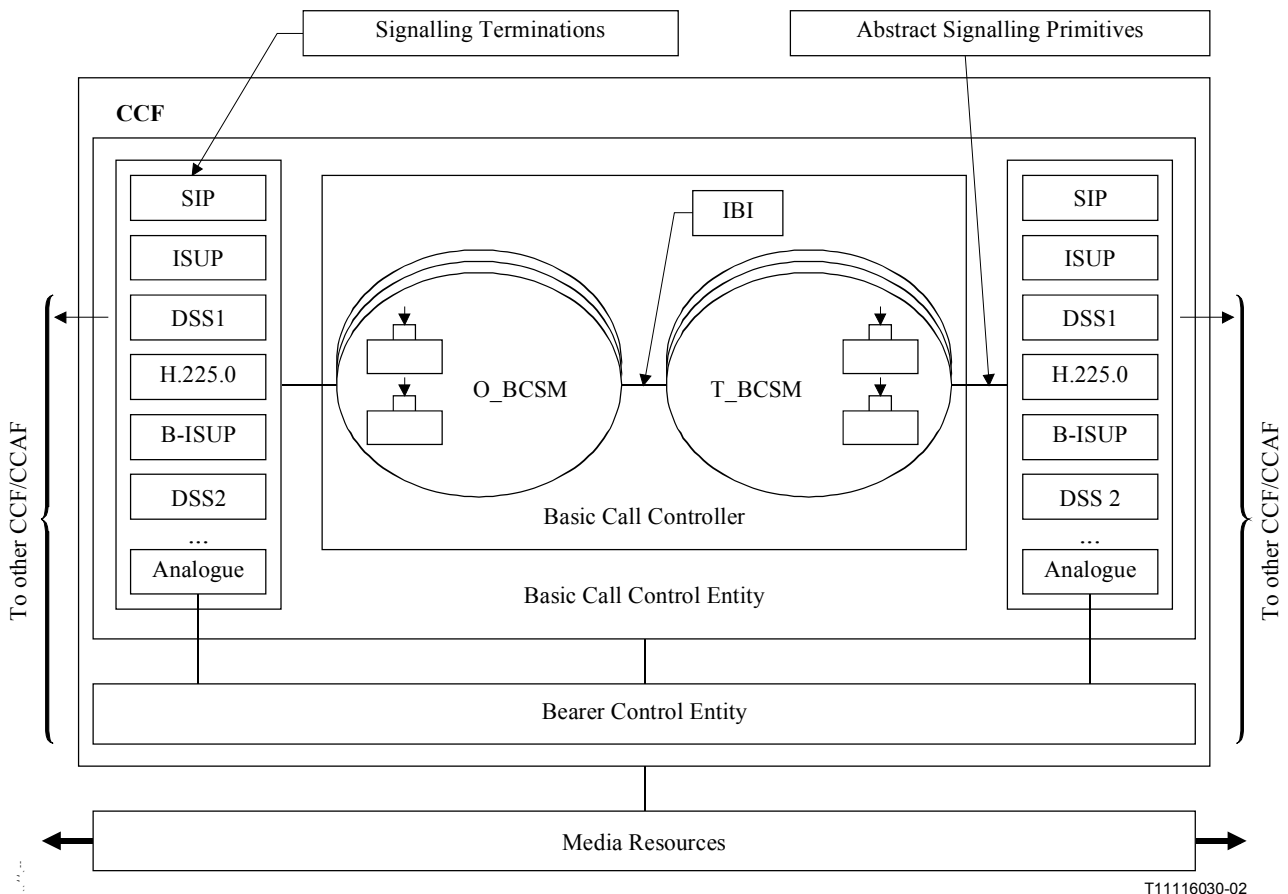


Figure 2/Q.1248.2 – Basic Call Control Entity

5.2.1.2 Basic Call Controller

The activities of the Basic Call Controller include:

- Creating and deleting BCSM instances.
- Routing signals (abstract signalling primitives) between BCSM instances and Signalling Terminations.
- Requesting services from the Bearer Controller (BRC).

The Basic Call Controller is the interface to the SSF. This relationship involves:

- Executing instructions that request the manipulation of one or more BCSM instances.
- Reporting events (i.e. DP) received from BCSM instances.

The Basic Call Controller is also in charge of relaying non-call processing related events between the SSF and the Signalling Terminations (e.g. USI information) or between the SSF and other local processes (e.g. charging information).

When executing instructions received from the SSF, the Basic Call Controller is responsible for the consistency between the configuration of the underlying bearer connections and the state of the Signalling Terminations FSM. As such, it may send an abstract signalling primitive to a Signalling Termination in order to bring the FSM to the correct state.

Example: As a result of an SCF instruction (e.g. MergeCallSegments), the Basic Call Controller Process may request the Bearer Controller Process to establish a physical connection between two parties, while the Signalling Termination associated to the originating half-call is not in the appropriate state (i.e. non answer received). In that case, the Basic Call Controller Process is responsible for sending the missing signal to the Signalling Termination.

The Basic Call Controller Process creates an O_BCSM instance under the following conditions:

- Receipt of a primitive from a Signalling Termination to initiate call establishment (i.e. Setup.Req)
- Receipt of an instruction from the SSF resulting from one of the following operations:
 - InitiateCallAttempt,
 - Connect in response to a TDP-R or EDP-R for a T_BCSM.

The Basic Call Controller creates a T_BCSM instance when it receives an indication from an O-BCSM instance that the PIC Send Call has been entered. After the T_BCSM has been created, the communication between the two instances uses the Inter-BCSM interface (IBI).

The Basic Call Controller Process deletes a BCSM instance under the following conditions:

- Indication from the BCSM that the Null state has been reached
- Receipt of an instruction from the SSF resulting from a MergeCallSegments operation.

For each BCSM instance it creates, the Basic Call Controller Process maintains the following knowledge:

- The reference of the peer BCSM instance.
- The reference of the associated Signalling Termination.
- The reference of the underlying bearer resource (i.e. Bearer Termination).

Using these references, the BCC can determine how many, and which BCSM instances are associated with the same Signalling Termination.

5.2.1.3 Signalling Terminations

Signalling Terminations provide adaptation functionalities between the Basic Call Controllers and signalling interfaces. Different types of Signalling Terminations may be available in a CCF. This depends on the list of signalling protocols supported by the exchange in which the CCF resides. Typical types of signalling terminations are:

- Analogue
- Q.763 ISUP,
- Q.931 DSS1
- Q.2763 B-ISUP,
- Q.2931 DSS2,
- H.225.0,
- SIP

NOTE – The signalling termination for analogue interfaces, requires access to the Bearer Controller in order to detect physical events such as off-hook/on-hook.

Each Signalling Termination embodies the knowledge of the signalling procedures defined for the supported protocol.

Signalling Termination instances communicates with the BCSM Controller Process, using a set of abstract signalling primitives defined in 5.2.6.2.

5.2.2 BCSM Model

5.2.2.1 Overview

The BCSM provides a high-level model description of CCF activities required to establish and maintain communication paths for users. As such, it identifies a set of basic call and connection activities in a CCF and shows how these activities are joined together to process a basic call and connection (i.e. establish and maintain a communication path for a user).

Many aspects of the BCSM are not externally visible to IN service logic instances. However, aspects of the BCSM that are reflected upward to the SSF are visible to IN service logic instances. Only these aspects of the BCSM will be the subject of standardization. As such, the BCSM is primarily an explanatory tool for providing a representation of CCF activities that can be analysed to determine which aspects of the BCSM will be visible to IN service logic instances, if any, and what level of abstraction and granularity is appropriate for this visibility.

The BCSM identifies points in basic call and connection processing when IN service logic instances are permitted to interact with basic call and connection control capabilities. In particular, it provides a framework for describing basic call and connection events that can lead to the invocation of IN service logic instances or should be reported to active IN service logic instances, for those points in call and connection processing at which these events are detected, and for describing those points in call and connection processing when the transfer of control can occur.

Figure 3 shows the components that have been identified to describe a BCSM, to include: points in call (PICs), detection points (DPs), BCSM transitions, and events. PICs identify CCF activities associated with one or more basic call/connection states of interest to IN service logic instances. DPs indicate states in basic call and connection processing at which transfer of control from non-IN to IN service logic can occur. Other states may exist (e.g. within PICs) where call processing is suspended but IN service logic cannot be invoked. BCSM transitions indicate the normal flow of basic call/connection processing from one PIC to another. Entry events cause BCSM transitions into PICs. Exit events represent the result of PIC processing.

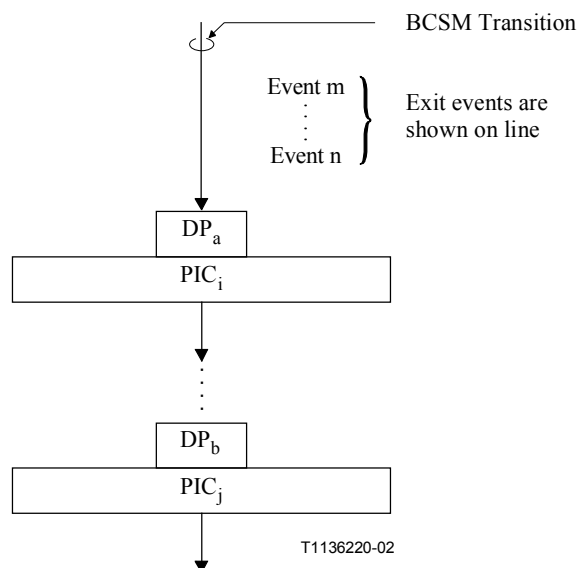


Figure 3/Q.1248.2 – BCSM components

The BCSM described in this clause is based on the overall BCSM in Annex A/Q.1204 and ITU-T Q.1224, refined as applicable.

The CCF model includes an originating half BCSM and a terminating half BCSM, each of which is managed by a functionally separate Basic Call Controller. This reflects the functional separation in the CCF model between the originating and terminating portions of calls that serve to isolate single-ended service logic instances related to the calling party from single-ended service logic instances related to the called party for the same call, i.e. the "half call" model approach.

The O_BCSM and T_BCSM respectively, model existing switch processing of a basic two-party call with the extended transitions as needed in support of IN call capabilities including CPH. In the following descriptions, the PICs are related at a high level to Q.931 ISDN call states. This is not intended to be a detailed formal definition of the relation between the PICs and Q.931 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 Q.931 call states may be traversed in certain situations that are considered below.

BCSM Information

In order 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 keep available a specific set of data until the calling (e.g. controlling) user releases the call and to ensure that software resources are returned to a coherent status when call processing passes through the PICs.

The BCSM Information depends on the applied signalling interface arrangement and is not listed in the following O/T_BCSM description. The general rule is that information that may be sent in the query (a service initiating operation as InitialDP or a DP specific operation) is to be maintained as long as an IN service could be triggered on the O/T_BCSM. More precise rules and mapping tables are provided in specific documents; e.g. ITU Q.1601.

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.

DP Naming

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

BCSM Transitions

The BCSM description provided hereafter only describes the *basic transitions* which occur when processing a basic two party call. A basic call signifies a call between two users that consists of communication only, and does not include additional features (ITU-T Q.1290).

The PIC entry event is normally the Resume instruction received from the SSF after the processing of a DP: "basic" transition DP to PIC. PIC exit events are the result of the processing of an event received from the signalling interface arrangement supported by IN: "basic" transitions PIC to DP/PIC. The transitions which may occur due to an SCF instruction ("extended" transitions from DP to DP/PIC) and which may change the basic evolution of the call are not described here. Later subclauses describe the complete set (i.e. also the "extended" transitions from DP to DP/PIC) of possible BCSM transitions for the O_BCSM and the T_BCSM respectively.

5.2.2.2 Originating BCSM

The originating half of the BCSM corresponds to that portion of the BCSM associated with the originating party.



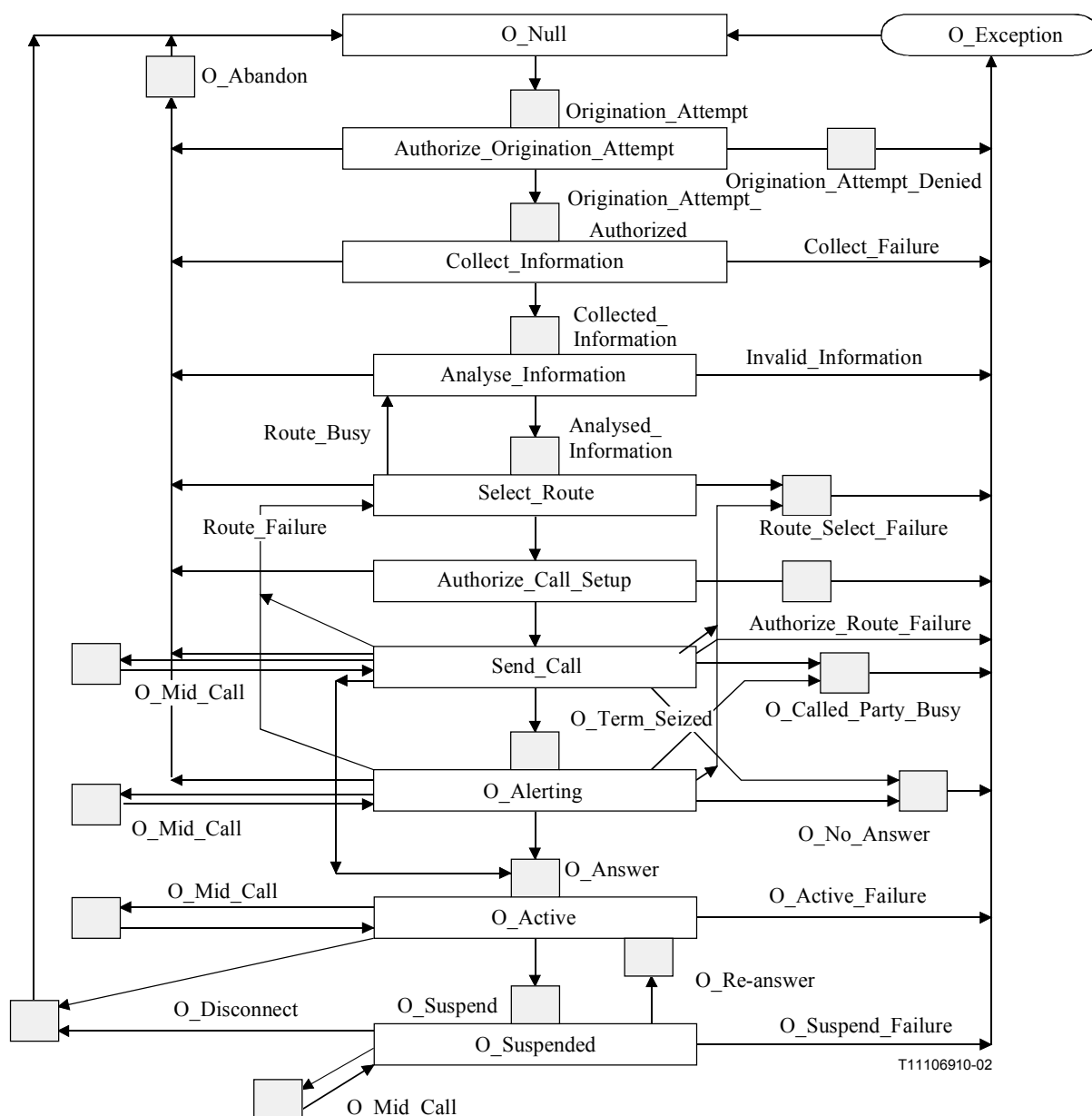


Figure 4/Q.1248.2 – Originating BCSM for IN CS-4: Basic Set of Transitions

The following information is available at all PICs in the O_BCSM

- Calling Party Class of Service (where locally available e.g. subscriber profile including calling party category information).
- Call Reference (where locally assigned in the switch).
- Terminal Type: see ITU-T Q.1290. The SCF uses this to determine the most appropriate form of user-interaction to use (e.g. in-band announcements). This information may only be available at originating local exchanges.
- Calling Party Facility Restriction Level (FRL). The permission level associated with an incoming facility, e.g. trunk line.
- Calling Party BGID (Business Group Identity).
- The Basic Business Group or Multiswitch Business Group Identity of the calling party, e.g. group-based services.

The above information applies in addition to Signalling Information received from the signalling interface and from the peer T_BCSM. The Signalling Information depends on the signalling interface arrangement applied: e.g. DSS1, DSS2, analogue user, conventional trunk, SS No. 7 trunk and N-ISUP or B-ISUP, private trunk, etc.

The description for each of the PICs in the originating half of the BCSM is provided below.

NOTE – See 5.2.4 "BCSM Indications for the CS-3 Call Model" for more information concerning PICs.

5.2.2.2.1 O_Null

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

Functions: Interface (line/trunk e.g. DSS1/N-ISUP or DSS2/B-ISUP interface) 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 CCF/SSF has the information corresponding to the Signalling Information received from the signalling interface arrangement as a Setup service request primitive is received (due to e.g. a DSS1 Setup, DSS2 Setup, N-ISUP IAM, B-ISUP IAM) available and associated with the originating call portion. If the CCF/SSF determines that the call origination attempt is denied, the cause of the failed authorization is also known. The above information applies in addition to the information available at all PICs in the O_BCSM.

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

Exit events

- Indication of desire to place an outgoing call by the receipt of a Setup service request primitive (e.g. due to off-hook, Q.931/Q.2931 setup message, N/B-ISUP IAM message). This event causes call processing to move to the Origination_Attempt DP.
- 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.

Corresponding Q.931 call state: O_Null.

NOTE – The O_Abandon event occurs when the originating party abandons the call before the call has been answered, i.e. when the calling party disconnects. For example, this event can result from one of the following:

- the CCF/SSF receives an on-hook indication from a caller served by a non-ISDN line, following switch-hook flash timing;
- the CCF/SSF receives a call clearing message from a caller served (e.g. by a narrow-band or broadband ISDN interface (DSS1/DSS2));
- the CCF/SSF receives a disconnect indication (e.g. from a conventional trunk or private facility trunk);
- the CCF/SSF receives a Release Message (e.g. from an SS No. 7 trunk, N-ISUP or B-ISUP interface).

5.2.2.2.2 Authorize_Origination_Attempt

Entry events: 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.

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

- Information as per the `O_Null` PIC.
- Authorization result: If the CCF/SSF determines that the origination attempt is denied, the cause of the failed authorization is also known.

Exit events

- An indication is received that the authorization is successful. This event causes call processing to move to the `Origination_Attempt_Authorized` DP.
- The `O_Abandon` event occurs when an indication of clearing or of originating party abandon is received. This event causes call processing to move to the `O_Abandon` DP.
- An indication is received that the call origination is denied. The `O_BCSM` moves to the `Origination_Attempt_Denied` DP.

5.2.2.2.3 Collect_Information

Entry events: 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 SS No. 7 trunk).
- The CCF/SSF 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 CCF/SSF may:
 - collect digits according to the normal dialling plan; or
 - collect a variable number of digits.

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

- Information as per the `O_Null` PIC.
- Collected Information: As obtained from the Setup service request and illustrated in the examples below.

The Collected Information may, e.g. consist of one or more of the following:

- Access Codes within a Customized Dialling Plan (CDP): see ITU-T Q.1290. 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 Q.1290 and Q.762 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 Q.1290. This information may be provided if and when facility selective service signalling is supported.
- Feature Activation: see Q.932 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.
- Carrier Access Code/Carrier Identification Code: see ITU-T Q.1290. The caller may dial a Carrier Access Code (CAC) (e.g. a 101XXXX for use on this call). When the caller is served by an ISDN interface, a Carrier Identification Code, i.e. XXXX, may be received by the CCF/SSF within the transit network selection information element of the ISDN SETUP message.
- Collected Address Information: see ITU-T Q.1290. Available as per the numbering plan.
- Numbering Plan Indicator: see Q.762 Numbering Plan Indicator signalling information.
- Collected Digits: see ITU-T Q.1290. 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 is to be collected using normal inter-digit timing. In this case, these collected digits are also known at this time.
- Charge Number: see ITU-T Q.1290. This is only known from a conventional trunk when Multi-Frequency signalling is used on the originating trunk (network operator specific). In this case, the charge number is provided in the second stage of overlap out pulsing.
- Numbering Plan Indicator: see Q.762 Numbering Plan Indicator signalling information. The address received is expected to conform to ITU-T E.164.
- Carrier Selection: see ITU-T Q.1290.
- Originating Line Information: see ITU-T Q.1290. 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.
- Travelling Class Mark (if provided) (included in the generic digits parameter of the IAM) see ITU-T Q.1290.

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.). This event causes call processing to move to the Collected_Information DP.
- The following exception exit events are applicable to this PIC: Collect_Failure. The Collect_Failure event encompasses events such as CollectTimeout, CollectInfoFailure and InvalidInformation.
 - The CollectTimeout event is detected when enough information to process the call was not received by the CCF/SSF before a normal inter-digit timer expires. For an SS No. 7 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 CCF/SSF 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.
 - The O_Abandon event occurs when an indication of clearing or of originating party abandon is received. This event causes call processing to move to the O_Abandon 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 (Note 1).

In the case of complete number (e.g. 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. 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 the query, i.e. an initialling DP request (i.e. InitialDP or CollectedInformation operation) to the SCF when enough digits are received to determine if the TDP criteria are met. It suspends BCSM processing but will collect further digits. It is network operator specific to determine when complete information is available (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 Q.931 call state: 1. Call Initiated and (optionally) 2. Overlap Sending.

5.2.2.2.4 Analyse_Information

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

Functions: Information being analysed and/or translated according to dialling plan to determine a destination (See ITU-T E.410) and call type (e.g. local exchange call, transit exchange call, international exchange call). To each destination, a list of routes is associated.

Based on the destination information derived from the analysis of the called party number, switched-based call gapping evaluation is performed. In case the called party number is modified by an IN service (i.e. in case a Connect operation is received), the switched-based call gapping evaluation is invoked each time the BCSM enters the Analyze_Info_PIC.

NOTE – The term "call gapping" should be understood as a CCF-based process which performs selective treatment of call establishment (e.g. releasing) in case of overload situations at switch-level. This process filters calls, as opposed to service triggering as is done by the SSF-based call gap process.

In the case that the SSF has received a list of CDPN in a Connect or AnalyseInformation operation, the CCF/SSF shall use the next CDPN in the list.

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

Parameters Received: DestinationRoutingAddress

Result: Busy or No Answer

Processing Order: CDPN1

Since no forwarding condition is specified, only the first CDPN is tried.

Parameters Received: DestinationRoutingAddress, ForwardingCondition

Result: Busy/No Answer

Processing Order: CDPN1

CDPN2

CDPN3

So long as the forwarding condition is met, the next CDPN is tried.

Parameters Received: RouteList, DestinationRoutingAddress

Result: No route out of local switch (busy)

Processing Order: Route1, CDPN1

Route2, CDPN1

Route3, CDPN1

No other CDPNs need be tried since there are no routes out of the switch.

Parameters Received: RouteList, DestinationRoutingAddress

Result: Route busy is found to be at a switch other than local switch

Processing Order: Route1, CDPN1

No other routes need be tried since the local route is successful, but a busy condition was encountered elsewhere. No other CDPNs are tried since forwarding condition does not apply.

Parameters Received: RouteList, DestinationRoutingAddress

Result: No answer received

Processing Order: Route1, CDPN1

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

No other CDPNs are tried since forwarding condition does not apply.

Only after the appropriate CDPNs/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 outgoing 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 CCF/SSF determines that the information has been analysed, it is assumed that the CCF/SSF has the following information available and associated with the originating portion of the call:

- Information as per the O_Null PIC.
- Analysis Results (of the Collected Information), as described in the examples below.

The Analysis Results consists of e.g. one or more of the following:

- Called Party Number.
- Numbering Plan Indicator.
See Q.762 Numbering Plan Indicator signalling information.
- Type Of Call: see ITU-T Q.1290.
- Carrier: see ITU-T Q.1290.
- Carrier Identification Code: see ITU-T Q.1290. Available for Internetwork carrier calls.
- Carrier Selection: see ITU-T Q.1290. Available for Inter-Serving Area ID carrier calls.
- 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.
- Charge Number: as defined in the O_Null PIC (for an SS No.7 trunk) or Collected_Information PIC (for a conventional trunk when EAMF signalling is used).
- Originating Line Information: see ITU-T Q.1290. Available for Inter-Serving Area ID carrier calls.
- Route Index: see ITU-T Q.1290. Available if this call does not terminate on this CCF/SSF.
- Travelling Class Mark: see ITU-T Q.1290. Available if received on the facility.

Exit events

- Availability of routing address and nature of address. This event causes call processing to move to the Analysed_Information DP.
- The following exception exit events are applicable to this PIC: InvalidInformation The InvalidInformation event occurs when the information received from the caller is not valid and no further treatment (like e.g. routing of the call to an announcement in case of a wrongly dialled number) can be applied to the call, for instance in case the information received violates the dialling plan in force.
- The O_Abandon event occurs when an indication of clearing or of originating party abandon is received. This event causes call processing to move to the O_Abandon DP.

Comments: Note that routing 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 routing to a specific private facility).

Corresponding Q.931 call state: Not applicable.

5.2.2.2.5 Select Route

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

Functions

- Routing 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.

NOTE – In a broadband environment, the switching system may select the path (VPI) and channel (VCI) in both directions of the connection.

- The individual destination resource of a resource group (e.g. a specific line if a multi-line hunt group) is not selected.
- When the entry event is the route failure event from the Send_Call PIC (see below), the CCF/SSF 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 in order to use the next CDPN.

If these three conditions mentioned above 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 CCF/SSF 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 routing over a public facility is allowed, or routing 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) have 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 SS No. 7 signalling. In this case, a Route_Select_Failure event is detected.

Information available: After the CCF/SSF determines the route has been selected, it is assumed the CCF/SSF has the following information available and associated with the originating portion of the call:

- Information as per 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 CCF/SSF), the CCF/SSF 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, the routing information includes Circuit Code information.

Exit events

- Route Selected event: Route selection is successful and call processing moves to Authorize_Call_Setup PIC.
- 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). This event causes call processing to move to the Route_Select_Failure DP. The event indication received from T_BCSM that causes call

processing to move to the O_Route_Select_Failure DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".

- The Route_Busy event leading to the Analyse_Information PIC as described above, or the following four 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 forwarding condition is busy, as specified by the ForwardingCondition parameter;
 - c) the route was determined by switch translations at the Analyse_Information PIC;
 - d) there are more CDPNs left to try.
- Route_Busy is a non-IN transition which is part of a basic call. This is needed in case the CCF/SSF needs to process a list of CDPNs. These CDPNs can be returned in a Connect or Analyse_Information message. Upon being unable to select a route, the Route_Busy BCSM transition returns to the Analyse_Information PIC to analyse the next CDPN in the list.
- Originating party abandons call (DP: O_Abandon).

5.2.2.2.6 Authorize_Call_Setup

Entry events: Route Selected event.

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

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

- Information as per the O_Null PIC.
- Analysis Results: see description in the Analyse_Information PIC.
- Routing Information: see description in the Select_Route PIC.

Exit events

- Call Setup Authorized event. The Call Setup Authorized event occurs when the authority to place the call is verified. For example for an SS No. 7-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 ISUP Continuity Message (COT) with a successful indication is received.
- The O_Abandon event occurs when an indication of clearing, or originating party abandon, is received. This event causes call processing to move to the O_Abandon DP.
- 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 example, for an SS No. 7-supported trunk interface, the Authorization Failure event occurs when the continuity check procedure results in failure. This event causes a BCSM transition to the Authorize_Route_Failure DP.

5.2.2.2.7 Send_Call

Entry events: Call Setup Authorized event.

Functions: The CCF/SSF 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, for example: Charge Number, Calling Party ID; Calling Party BGID; Calling Party Category (determined by the Class of Service information or ISUP originating line information parameter); Bearer Capability; Called Party ID; Calling Party Subaddress; Called Party Subaddress; Forward GVNS, 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.

Examples of functions during the processing that this PIC models:

For an ISDN or B-ISDN caller, the CCF/SSF returns a CALL PROCEEDING message. For non-ISDN lines, conventional trunks, and private-facility trunks, no treatment is applied.

For SS No. 7-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.

For B-ISUP interfaces, the CCF/SSF returns an IAM acknowledgement message (IAA).

Information available: After the CCF/SSF determines the call has been delivered (to the terminating half), it is assumed the CCF/SSF has the following information available and associated with the originating portion of the call:

- Information as per the O_Null PIC.
- Analysis Results: see description in the Analyse_Information PIC;
- Routing Information: see description in the Select_Route PIC;
- Feature Activation Information: see description below: A service feature request is received from the originating party: e.g. hook-flash, ISDN feature activator, DTMF provided control code.

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.
 - iii) the following four 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 PIC);
 - b) the forwarding condition is busy, as specified by the ForwardingCondition parameter;
 - c) the route was determined by switch translations at the Analyse_Information PIC;
 - d) there are more CDPNs left to try.
 - iv) the following four 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 forwarding condition is busy, as specified by the ForwardingCondition parameter;
- c) the route was determined by the switch translations at the Analyse_Information PIC;
- d) there are more CDPNs left to try.
- v) the following three conditions are met, hereafter called Route Failure Condition 3:
 - a) O_Called_Party_Busy event or O_No_Answer event occurs (as specified below);
 - b) the forwarding condition is met, as specified by the ForwardingCondition parameter;
 - c) there are more CDPNs left to try.

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 if this event is not detected at a DP (e.g. more CDPNs left to try).

Otherwise, this event causes call processing to move to the O_Route_Select_Failure DP or O_Called_Party_Busy DP (e.g. User Busy, Subscriber absent (not reachable) or O_No_Answer DP or O_Exception). Which DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".

- 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 (e.g. like 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). This event causes call processing to move to the O_Term_Seized DP.

For example, in ISDN this certain abnormal case occurs 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 event is detected from the originating party: e.g. hook-flash, ISDN feature activator, DTMF provided control code. This event causes call processing to move to the O_Mid_Call DP.

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 SS No. 7-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 or signalling event. 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 CCF/SSF reports the event to the SCF. The event indication received that causes call processing to move to the O_No_Answer DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".
- 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, "Call Rejected" conditions are also treated as O_Called_Party_Busy events.
In this case, the terminating portion of the call is cleared. The event that causes call processing to move to the O_Called_Party_Busy DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".
- For SS No. 7-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.
- The O_Abandon event occurs when an indication of clearing or of originating party abandon is received. This event causes call processing to move to the O_Abandon DP.

5.2.2.2.8 O_Alerting

Entry events: O_Term_Seized event (DP: O_Term_Seized).

Functions

- Wait for the terminating party to answer. At this point, the caller receives in-band audible ringing (from the terminating switch). For example 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 call progress indication being sent backward, e.g. CPG being sent on an SS No. 7-supported trunk (if the originating access is an SS No. 7-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 CCF/SSF is in this PIC, it is assumed the CCF/SSF has the following information available and associated with the originating portion of the call:

- Information as per the O_Null PIC.
- Analysis Results: see description in the Analyse_Information PIC.
- Routing Information: see description in the Select_Route PIC.
- Feature Activation Information: see description below:

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

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, Q.931 Connect message received, ISUP Answer message received). This event causes call processing to move to the O_Answer DP. When the O_Answer event occurs, the treatment applied is described in the Send_Call PIC.
- A service feature request event is detected from the originating party: e.g. hook-flash, ISDN feature activator, DTMF provided control code. The detection of this event causes call processing to move to the O_Mid_Call DP.
- A route failure event is detected when:
 - i) the following conditions are met, hereafter called Route Failure Condition 3:
 - a) O_Called_Party_Busy event or O_No_Answer event occurs (as specified below);
 - b) the forwarding condition is met, as specified by the ForwardingCondition parameter;
 - c) there are more CDPNs left to try.

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 if this event is not detected at a DP (e.g. more CDPNs left to try).

Otherwise this event causes call processing to move to the O_Route_Select_Failure DP or O_Called_Party_Busy DP (e.g. User Busy, Subscriber absent (not reachable) or O_No_Answer DP or O_Exception). Which DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".

- 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. That is, the event indication received that causes call processing to move to the O_No_Answer DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".
- From this PIC, the O_Called_Party_Busy event occurs either when:
 - i) a Call Rejected event specifying user busy is received; or
 - ii) when 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). The event that causes call processing to move to the O_Called_Party_Busy DP depends upon the event reason (cause value) as defined according to Table 3 "O_BCSM: Mapping Cause value to DP".

- The O_Abandon event occurs when an indication of call clearing or of originating party abandon is received. This event causes call processing to move to the O_Abandon DP.

5.2.2.2.9 O_Active

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

Functions: In this PIC several processes may be initiated e.g.:

- 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.
- The called party may be put on hold by a service logic and when the calling party disconnects, the calling party can be reconnected to the held call by the Reconnect operation. The calling user receives appropriate information (e.g. ringing) and a reconnection timer is applied.

Information available: Once the CCF/SSF has received an indication from the terminating half BCSM that the call has been answered, it is assumed the CCF/SSF has the following information available and associated with the originating portion of the call:

- Information as per the O_Alerting PIC.
- Feature Activation Information – A service or feature request from a party.

Exit events

- A service/service feature request is received from a party (e.g. DTMF provided control code, hook flash, ISDN feature activator, Q.931 HOLD or RETRIEVE message from originating party only) or a new reply from calling party (Reconnect procedure). The detection of this event causes call processing to move to the O_Mid_Call DP.
- A disconnect indication is received from the terminating party (non-ISDN subscriber) via the terminating half BCSM. This event causes call processing to move to the O_Suspend DP. A disconnect timing is associated with this BCSM transition.
- A disconnect indication is received from the originating party or terminating party (ISDN). This event causes call processing to move to the O_Disconnect DP.
- An indication of expiration of the reconnection timer is received. (O_Exception).
- A connection failure occurs. (O_Exception).

Comments:

- If originating party abandons call while suspended at O_Answer DP a transition to DP: O_Abandon shall occur.
- Disconnect treatment and timing is different for call attempts originating from ISDN and analogue line interfaces, e.g. at a release in the ISDN network from an ISDN line a transition direct to O_Disconnect DP occurs.

Corresponding Q.931 call state: 10. Active

Q.931 call states corresponding to disconnect: 11. Disconnect request, 12. Disconnect indication and 19. Release request.

5.2.2.2.10 O_Suspended

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

Functions

- The connection between the originating and terminating party is maintained and depending on the incoming network connection, appropriate backward signalling takes place.
 - In the 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, e.g. follow-on call initiated by O_Mid_Call. DP
 - 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 this IN Capability Set BCSM.
- The called party may be put on hold and returned to the active phase by a service logic.
- The called party may be put on hold by a service logic and when the calling party disconnects, the calling party can be reconnected to the suspended call by the Reconnect operation. The calling user receives appropriate information (e.g. ringing) and a reconnection timer is applied. The timer may have been started in the active phase.

Information available: It is assumed the CCF/SSF has the following information available and associated with the originating portion of the call:

- Information as per the O_Active PIC.

Exit events

- Connection to the terminating party is resumed. The O_BCSM returns to the O_Active PIC. This event causes call processing to move to the O_Re-answer DP.
- A service feature request is received from the originating party, e.g. hook flash, DTMF provided control code, ISDN feature activator of facility or a new reply from calling party (Reconnect procedure). The detection of this event causes call processing to move to the O_Mid_Call DP.
- A disconnection indication is received from the originating party. This event causes call processing to move to the O_Disconnect DP.
- A disconnection indication is received from the terminating party. This event causes call processing to move to the O_Disconnect DP.
- An indication of expiration of the timer waiting for re-answer request is received from the T_BCSM. This event causes call processing to move to the O_Disconnect DP.
- A trigger at O_Mid_Call is not initiated during an appropriate period (DP: O_Disconnect).
- An indication of expiration of the calling party reconnection timer is received (O_Exception).
- 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. a follow-on call.

5.2.2.2.11 O_Exception

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

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

NOTE – Depending on the connection view state, this should be handled in the physical plane via an ABORT protocol procedure to close the relationship (i.e. close the TCAP transaction) or via the sending of an EntityReleased operation with the relevant cause. This indicates in both cases that any outstanding operations on the corresponding entity (leg or CS) will not be run to completion.

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

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

5.2.2.3 Terminating BCSM

The terminating half of the BCSM corresponds to that portion of the BCSM associated with the terminating party.

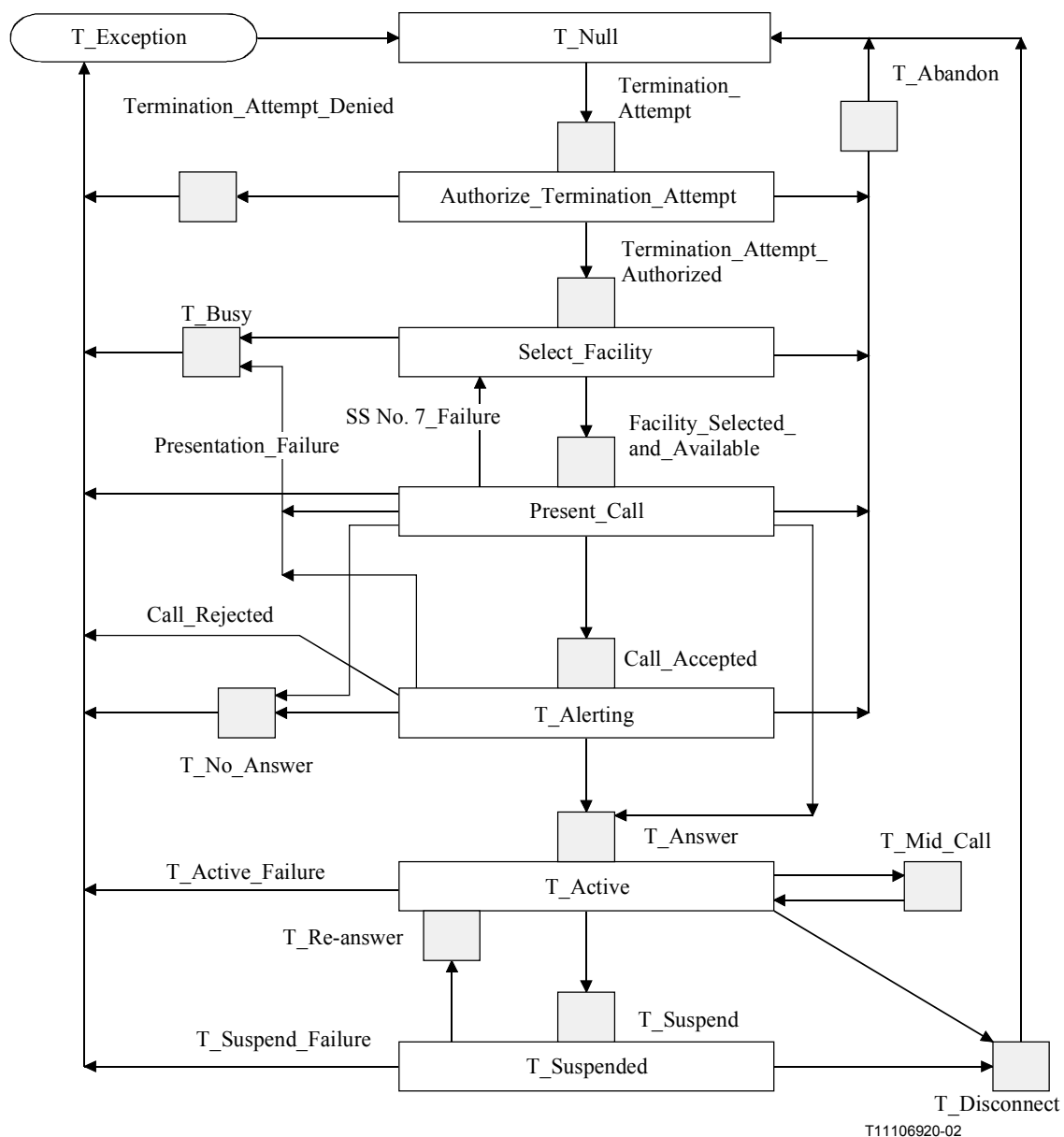


Figure 5/Q.1248.2 – Terminating BCSM for IN CS-4: Basic Set of Transitions

The following information is available at all PICs in the T_BCSM:

- Same information as associated with the originating BCSM is assumed to be available. See clause defining the information available at all PICs in the O_BCSM.
- Called Party Class of Service (where locally available, e.g. subscriber profile including called party category information).
- Call Reference (where locally assigned in the switch).
- Called Party Terminal Type: see ITU-T Q.1290. The SCF uses this to determine the most appropriate form of user-interaction to use (e.g. in-band announcements). This information may only be available at terminating local exchanges.
- Called Party Facility Restriction Level (FRL). The permission level associated with an outgoing facility, e.g. trunk line.
- Called Party BGID (Business Group Identity): The Basic Business Group or Multiswitch Business Group Identity of the called party, e.g. group-based services.

The above information applies in addition to Signalling Information received from the signalling interface and from the peer O_BCSM. The Signalling Information depends on the signalling interface arrangement applied: DSS1, DSS2, analogue user, conventional trunk, SS No. 7 trunk and N-ISUP or B-ISUP, private trunk, etc. The descriptions for each of the PICs in the terminating half of the BCSM are described below.

NOTE – See 5.2.4 "BCSM Indications for the CS-4 Call Model" for more information concerning PICs.

5.2.2.3.1 T_Null

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

Functions: The Interface (e.g. line/trunk; DSS1/N-ISDN or DSS2/B-ISDN) is idled (no call exists, no call reference exists, etc.). Supervision is being provided.

Information available: Once the CCF/SSF has detected the Termination_Attempt event, it is assumed that the CCF/SSF has the information corresponding to the Signalling Information received from the signalling interface obtained from the Setup service request primitive (e.g. DSS1 Setup, DSS2 Setup, N-ISUP IAM, B-ISUP IAM) available and associated with the terminating portion of the call. The above information applies in addition to the information available at all PICS in the T_BCSM.

NOTE 1 – Information associated with the originating portion of the call as per the Send_Call PIC is assumed to be available: This information is received from the originating call portion, i.e. the peer O_BCSM.

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

Exit events

- Indication of incoming call received from originating half BCSM. This event causes call processing to move to the Termination_Attempt DP.
- The following exception exit event 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 Q.931 call state: 0. Null

NOTE 2 – The T_Abandon event occurs when an indication of call disconnection is received from the originating portion of the call before the call has been answered, i.e. when the calling party disconnects. For example, this event can result from one of the following:

- the CCF/SSF receives an on-hook indication from a caller served by a non-ISDN line, following switch-hook flash timing;
- the CCF/SSF receives a call clearing message from a caller served by an ISDN interface;
- the CCF/SSF receives a disconnect indication from a conventional trunk or private facility trunk;
- the CCF/SSF receives a Release Message from an SS No. 7 trunk.

5.2.2.3.2 Authorize_Termination_Attempt

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

Functions: 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 CCF/SSF has the same information available for the terminating call portion after the Termination_Attempt_Authorized event is detected as it does when the Termination_Attempt event is detected in the T_Null PIC.

- Information as per the T_Null PIC.
- Authorization result: If the CCF/SSF determines that the termination attempt is denied, the cause of the failed authorization is also known.

Exit events

- Termination_Attempt_Authorized event. This event occurs when the switch has verified the authority to terminate the call to the terminating access. This event causes call processing to move to the Termination_Attempt_Authorized DP.
- The Termination_Attempt_Denied event occurs when the authority to route these calls to the terminating user is denied. This causes a BCSM transition to the Termination_Attempt_Denied DP.
- The T_Abandon event occurs when an indication of clearing, or of originating party abandon, is received from the originating portion of the call. This event causes call processing to move to the T_Abandon DP.

5.2.2.3.3 Select Facility

Entry events: Termination_Attempt_Authorized event (DP: Termination_Attempt_Authorized) or an SS No. 7 failure occurs causing a re-attempt. The SS No. 7 failure in the Present_Call can be caused by a timer expiry upon sending the first Circuit Reservation Message (CRM), if applicable or a continuity check failure.

Functions: 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 a 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, SS No. 7-supported trunks, and private-facility trunks, busy is when all trunks within the selected trunk group are busy.
- For a connection terminating to a B-ISUP interface, network-determined user busy is the detection of one or more of the following cause values in an Incoming Resources Rejected Request:
 - Resource Unavailable – Unspecified: There are no idle Signalling Identification Values.
 - No VPCI/VCI Available: There is no VPCI or VCI available.
 - User Cell Rate Not Available: There is a lack of bandwidth for the connection.
- For a call terminating to a B-ISDN DSS2 interface, network-determined user busy is the detection of one or more of the following conditions:
 - VPCI/VCI Not Available: There are no VPCIs or VCIs available to allocate to the connection.
 - Requested VPCI/VCI Not Available: The requested VPCI or VCI is not available to allocate to the connection.
 - Quality of Service unavailable: Requested Quality of Service or End-to-End Transit Delay not acceptable.
 - Resources Unavailable – Unspecified: Requested Cell rate in the ATM Traffic Descriptor is not available.

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:

- Information as per the Authorize_Termination_Attempt PIC.
- Facility Group: see ITU-T Q.1290. For calls routed out of this CCF/SSF, 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 DSS1 interface within the CCF/SSF, this may identify a particular Multi-line Hunt Group.
- Facility Group Member: see ITU-T Q.1290. For calls out of this CCF/SSF, this identifies the trunk (private or public) that has been selected to route the call on. For calls terminating to a non-ISDN line DSS1 interface on the CCF/SSF, 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, VPCI/VCI, call reference or trunk) could be found). This event causes call processing to move to the Facility_Selected_and_Available DP.
- 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). The event indication that causes call processing to move to the T_Busy DP depends upon the event reason (cause value) as defined according to Table 4 "T_BCSM: Mapping Cause value to DP".

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 or of originating party abandon is received from the originating portion of the call. This event causes call processing to move to the T_Abandon DP.

5.2.2.3.4 Present Call

Entry events: Facility_Selected_and_Available event. (DP: Facility_Selected_and_Available)

Functions: Terminating resource informed of incoming call (e.g. line seizure, Q.931 Setup message, ISUP 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:

- 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 SS No. 7 or not and whether the originating access is ISDN or non-ISDN.

Exit events

- Terminating party is being alerted (e.g. ringing being applied, Q.931 ALERTING message, ISUP-ACM message). This event causes call processing to move to the Call_Accepted DP.
- Call is accepted and answered by terminating party (e.g. terminating party goes off-hook, Q.931 Connect message received, ISUP answer message received). This event causes call processing to move to the T_Answer DP.
- The T_No_Answer event occurs when the terminating party does not answer before the No_Answer timer expires or when an ISDN user rejects the call with an explicit "no answer" indication. An indication of T_No_Answer event is passed to the originating half of the BCSM. The event indication received that causes call processing to move to the T_No_Answer DP depends upon the event reason (cause value) as defined according to Table 4 "T_BCSM: Mapping Cause value to DP".
- The T_Abandon event occurs when an indication of clearing or of originating party abandon is received from the originating portion of the call. This event causes call processing to move to the T_Abandon DP.
- A timer expiry upon sending the first Circuit Reservation Message (CRM) or a continuity check failure. (SS No. 7 failure). This event causes call processing to move to the Select Facility PIC.
- Presentation Failure exception event may happen if the call cannot be presented by the T_Busy event.
- The T_Busy event occurs if the call cannot be presented due to an ISDN user determined busy, ISUP release message with busy cause, not reachable subscriber condition; this event is notified to the originating call portion (send Call PIC). The event indication that causes call processing to move to the T_Busy DP depends upon the event reason (cause value) as defined according to Table 4 "T_BCSM: Mapping Cause value to DP" Otherwise this event causes call processing to move to the T_Exception.

Corresponding Q.931 call state: 6. Call present

5.2.2.3.5 T_Alerting

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

Functions: An indication is sent to the originating half BCSM that 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 the CCF/SSF has the following information available and associated with the terminating portion of the call:

- Information as per the Present_Call PIC.

Exit events

- Call is accepted and answered by terminating party (e.g. terminating party goes off-hook, Q.931 CONNect message received, ISUP answer message received). This event causes call processing to move to the T_Answer DP.
- 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 being alerted.
 - The T_No_Answer event occurs when the terminating party does not answer before the No_Answer timer expires or when an ISDN user rejects the call with an explicit "no answer" indication. An indication of T_No_Answer event is passed to the originating half of the BCSM. The event indication received that causes call processing to move to the T_No_Answer DP depends upon the event reason (cause value) as defined according to Table 4 "T_BCSM: Mapping Cause value to DP".
 - The T_Busy event occurs if the call cannot be presented due to, e.g. ISDN user determined busy, ISUP release message with busy cause, not reachable subscriber, etc. This event causes call processing to move to the T_Busy DP and is notified to the originating call portion (Alerting PIC). The event that causes call processing to move to the T_Busy DP depends upon the event reason (cause value) as defined according to Table 4 "T_BCSM: Mapping Cause value to DP". Otherwise this event causes call processing to move to the T_Exception.
 - The T_Abandon event occurs when an indication of clearing or of originating party abandon is received from the originating portion of the call. This event causes call processing to move to the T_Abandon DP.

Comment: For terminations to SS No. 7 trunk groups, this PIC is entered upon the receipt of an address complete (ACM) message.

Corresponding Q.931 call states: 7. Call received and 8. Connect request.

5.2.2.3.6 T_Active

Entry events: Call is accepted and answered by terminating party (e.g. terminating party goes off hook, Q.931 Connect message received, ISUP answer message received). (DP: T_Answer).

Functions: In this PIC several processes may be initiated:

- An indication is sent to the originating 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.
- The calling party may be put on hold by a service logic and when the called party disconnects, the called party can be reconnected to the held call by the Reconnect operation. The called user receives appropriate information (e.g. ringing) and a reconnection timer is applied. The timer may have been started in the active phase.

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:

- Information as per T_Alerting.
- Feature Activation Information: see description below. A service feature request is received from a party: (e.g. hook-flash, ISDN feature activator, DTMF provided control code, Q.932 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, Q.931 HOLD or RETRIEVE message from a terminating party only). The detection of this event causes call processing to move to the T_Mid_Call DP.
- A disconnect indication (e.g. on-hook, Q.931 disconnect message, SS No. 7 release message) is received from the terminating party (non-ISDN). This event causes call processing to move to the T_Suspend DP.
- A disconnect indication is received from the originating party via the originating half BCSM or from the terminating party (ISDN). This event causes call processing to move to the T_Disconnect DP.
- An indication of expiration of the reconnection timer is received. (T_Exception).
- A connection failure occurs. (T_Exception).

Comments:

- If originating party abandons call while suspended at T_Answer DP, a transition to T_Abandon DP shall occur.
- Disconnect indications and treatment are asymmetrical in the way disconnect timing is applied.

Corresponding Q.931 call state: 10. Active

Q.931 call states corresponding to T_Disconnect: 11. Disconnect request, 12. Disconnect indication, and 19. Release request

5.2.2.3.7 T_Suspended

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

Functions: 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 SS No. 7-supported trunk or an ISDN interface, in the case that a disconnect indication (e.g. Q.931 disconnect message, SS No. 7 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 SS No. 7-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, SS No. 7 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 CCF/SSF has the following information available and associated with the terminating call portion.

- Information as per the T_Active PIC.

Exit events

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

5.2.2.3.8 T_Exception

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

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

NOTE – Depending on the connection view state, this should be handled in the physical plane via an ABORT protocol procedure to close the relationship (i.e. close the TCAP transaction) or via the sending of an EntityReleased operation with the relevant cause. This indicates in both cases that any outstanding operations on the corresponding entity (leg or CS) will not be run to completion.

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

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

5.2.3 BCSM Resume Points and BCSM Transitions in the IN CS-4 Call Model

5.2.3.1 Originating BCSM: Detailed Set of O_BCSM Transitions

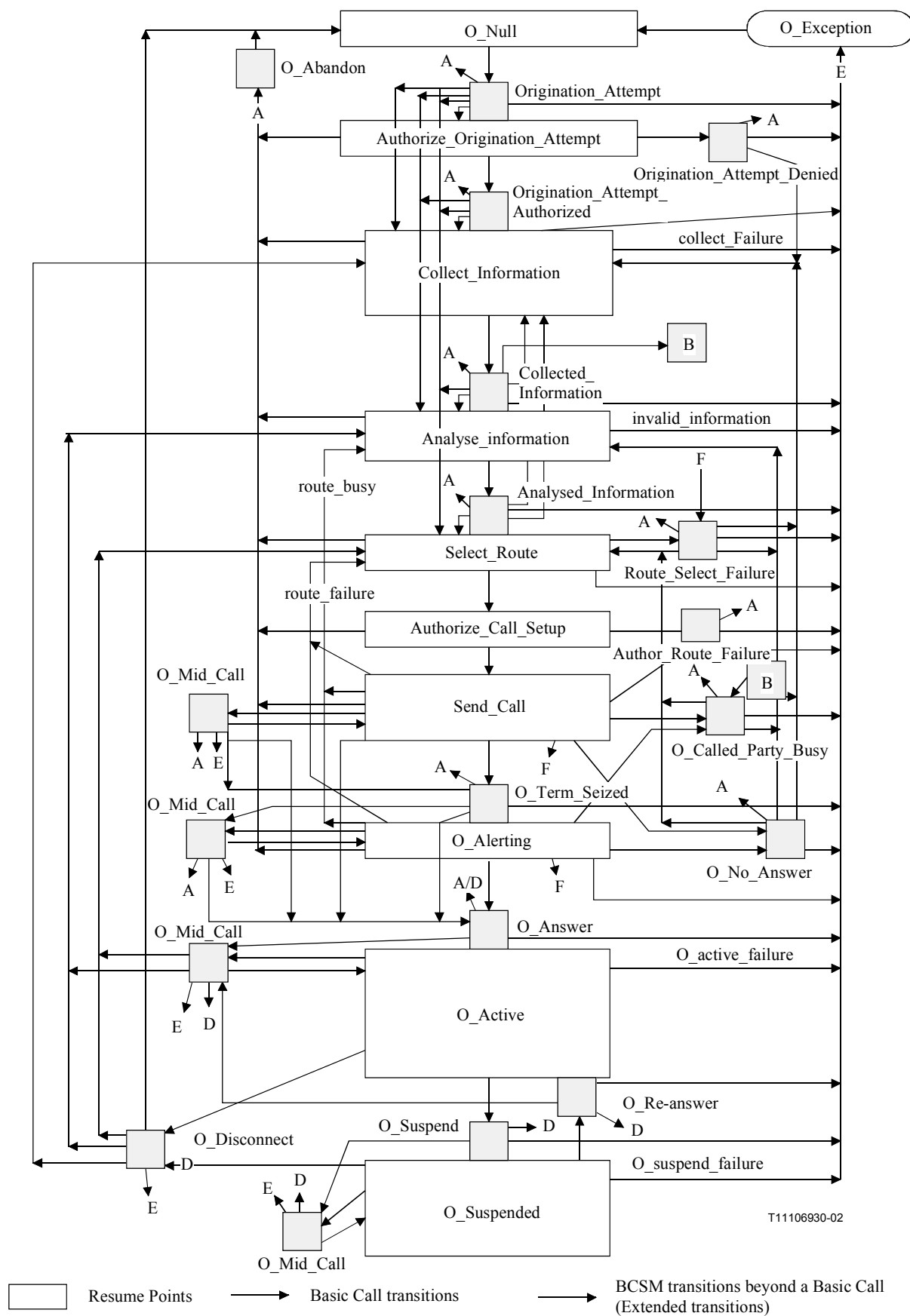


Figure 6/Q.1248.2 – Detailed Set of O_BCSM Transitions

Table 1 together with Figure 6 above describe the complete set of possible BCSM transitions for the originating call model. The nature of the O_BCSM transitions is given in the third column.

Basic

Basic transitions refer to normal processing of a basic call, i.e. a two-party call. The basic call process resumes in sequence of PIC and DP (e.g. Continue).

Extended

The basic call process progresses in non-sequence of PIC and DP compared to a basic call due to SCF instruction (e.g. Analysed_Information, ReleaseCall (e.g. early determined "busy" cause) or CCF call control instruction.

Table 1/Q.1248.2 – Complete Set of O_BCSM Transitions for the IN CS-4 Model

O_BCSM: Transitions from DP to DP/PIC_		
From	To	Nature of BCSM Transitions
Origination_Attempt DP	Authorize_Origination_Attempt PIC	Basic
	Collect_Information PIC	Extended
	Analyse_Information PIC	Extended
	Select_Route PIC	Extended
	O_Exception PIC	Extended
	O_Abandon DP	Extended
Origination_Attempt_Denied DP	Collect_Information PIC	Extended
	O_Abandon DP	Extended
	O_Exception PIC	Basic
Orig_Attempt_Authorized DP	Collect_Information PIC	Basic
	Analyse_Information PIC	Extended
	Select_Route PIC	Extended
	O_Exception PIC	Extended
	O_Abandon DP	Extended
Collected_Information DP	Collect_Information PIC	Extended
	Analyse_Information PIC	Basic
	Select_Route PIC	Extended
	O_Exception PIC	Extended
	O_Abandon DP	Extended
Analyse_Information DP	Collect_Information PIC	Extended
	Analyse_Information PIC	Extended
	Select_Route PIC	Basic
	O_Exception PIC	Extended
	O_Abandon DP	Extended
	O_Called_Party_Busy DP	Extended

Table 1/Q.1248.2 – Complete Set of O_BCSM Transitions for the IN CS-4 Model

O_BCSM: Transitions from DP to DP/PIC_		
From	To	Nature of BCSM Transitions
Authorize_Route_Failure DP	Analyze_Information PIC Select_Route PIC O_Abandon DP O_Exception PIC	Extended Extended Extended Basic
O_Term_Seized DP	O_Alerting PIC O_Answer DP (Note 1) O_Mid_Call DP (Note 3) O_Exception PIC O_Abandon DP	Basic Extended Extended Extended Extended
Route_Select_Failure DP	Collect_Information PIC Analyze_Information PIC Select_Route PIC O_Abandon DP O_Exception PIC	Extended Extended Extended Extended Basic
O_Called_Party_Busy DP	Collect_Information PIC Analyze_Information PIC Select_Route PIC O_Abandon DP O_Exception PIC	Extended Extended Extended Extended Basic
O_No_Answer DP	Collect_Information PIC Analyze_Information PIC Select_Route PIC O_Abandon DP O_Exception PIC	Extended Extended Extended Extended Basic
O_Answer DP	O_Active PIC O_Mid_Call DP (Note 3) O_Exception PIC O_Disconnect DP (Note 2) O_Abandon DP	Basic Extended Extended Extended Extended
O_Suspend DP	O_Suspended PIC O_Disconnect DP O_Mid_Call DP (O_Suspended PIC) O_Exception PIC	Basic Extended Extended Extended
O_Re-Answer DP	O_Active PIC O_Disconnect DP O_Mid_Call_Active DP O_Exception PIC	Basic Extended Extended Extended

Table 1/Q.1248.2 – Complete Set of O_BCSM Transitions for the IN CS-4 Model

O_BCSM: Transitions from DP to DP/PIC_		
From	To	Nature of BCSM Transitions
O_Mid_Call DP (Send Call PIC)	Send_Call PIC	Basic
	O_Mid_Call DP (Send_Call PIC)	Extended
	O_Term_Seized DP (Note 1)	Extended
	O_Answer DP (Note 1)	Extended
	O_Exception PIC	Extended
	O_Abandon DP	Extended
O_Mid_Call DP (O_Alerting PIC)	O_Alerting PIC	Basic
	O_Mid_Call DP (O_Alerting PIC)	Extended
	O_Answer DP (Note 1)	Extended
	O_Exception PIC	Extended
	O_Abandon DP	Extended
O_Mid_Call DP (O_Active PIC)	O_Active PIC	Basic
	Analyse_Information PIC	Extended
	Select_Route PIC	Extended
	O_Mid_Call DP (O_Active PIC)	Extended
	O_Exception PIC	Extended
	O_Disconnect DP	Extended
O_Mid_Call DP (O_Suspended PIC)	O_Suspended PIC	Basic
	Analyse_Information PIC	Extended
	Select_Route PIC	Extended
	O_Mid_Call DP (O_Suspended PIC)	Extended
	O_Exception PIC	Extended
O_Disconnect DP	O_Null PIC	Basic
	Collect_Information PIC	Extended
	Analyse_Information PIC	Extended
	Select_Route PIC	Extended
	O_Exception PIC	Extended
	O_Disconnect DP	Extended
O_Abandon DP	O_Null PIC	Basic
NOTE 1 – The DP reporting ensures that the SCF will receive the events in the correct order. For example, in the case where the FSM for CS is in "Waiting for Instructions" state due to an O_Mid_Call EDP-R (SendCall) being reported, and in this state O_Term_Seized and O_Answer events are detected, followed by the O_Disconnect event. NOTE 2 – Release from called party. NOTE 3 – If e.g. a DisconnectLeg (p) or MoveLeg (p) is received while call processing is suspended at DP O_Term_Seized respective O_Answer, the O_BCSM for leg c transits to the O_MidCall DP of the Send_Call PIC respective O_Alerting PIC (not of the O_Alerting PIC respective O_Active PIC as answer has not been sent backward on the c-leg).		

Table 1/Q.1248.2 – Complete Set of O_BCSM Transitions for the IN CS-4 Model

O_BCSM: Transitions from PIC to PIC/DP		
From	To	Nature of BCSM Transitions
O_Null PIC	Origination_Attempt DP	Basic
Authorize_Origination_Attempt PIC	Origination_Attempt_Authorized DP Origination_Attempt_Denied DP O_Abandon DP O_Exception PIC	Basic 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
Select_Route PIC	Analyse_Information PIC Authorize_Call_Setup PIC Route_Select_Failure DP O_Abandon DP O_Exception PIC	Basic Basic Basic Basic Basic
Authorize_Call_Setup PIC	Send_Call PIC Authorize_Route_Failure DP O_Abandon DP O_Exception PIC	Basic Basic Basic Basic
Send_Call PIC	O_Term_Seized DP O_Mid_Call DP (Send_Call PIC) O_Called_Party_Busy DP O_Answer DP O_No_Answer DP Select_Route PIC O_Abandon DP O_Exception PIC Analyse_Information PIC	Basic Basic Basic Basic Basic Basic Basic Basic Extended
O_Alerting PIC	Route_Select_Failure DP O_Mid_Call DP O_Answer DP O_No_Answer DP O_Called_Party_Busy DP O_Abandon DP O_Exception PIC Analyse_Information PIC	Basic Basic Basic Basic Basic Basic Basic Extended

Table 1/Q.1248.2 – Complete Set of O_BCSM Transitions for the IN CS-4 Model

O_BCSM: Transitions from PIC to PIC/DP		
From	To	Nature of BCSM Transitions
O_Active PIC	O_Midcall DP	Basic
	O_Disconnect DP	Basic
	O_Suspend DP	Basic
	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

5.2.3.2 Terminating BCSM: Detailed Set of T_BCSM Transitions

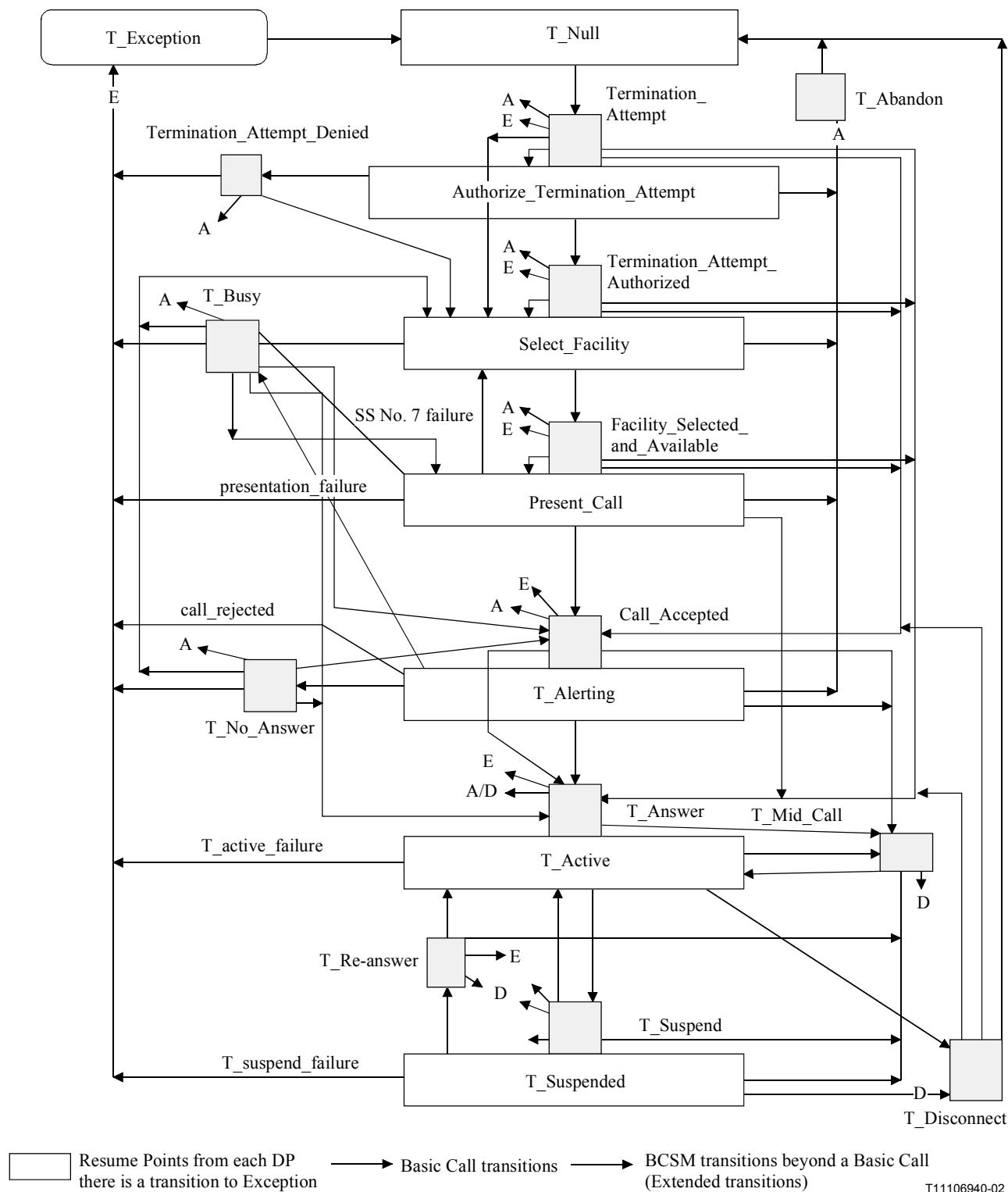


Figure 7/Q.1248.2 – Detailed Set of T_BCSM Transitions

Table 2 together with Figure 7, describe the complete set of possible T_BCSM transitions for the terminating call model. The nature of the T_BCSM transitions is given in the third column.

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