
**Information technology — Open Systems
Interconnection — Protocol for the
Commitment, Concurrency and Recovery
service element: Protocol specification**

*Technologies de l'information — Interconnexion de systèmes ouverts
(OSI) — Protocole pour l'élément de service d'engagement, de
concomitance et de rétablissement: Spécification du protocole*

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 9805-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 33, *Distributed application services*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.852.

This third edition cancels and replaces the second edition (ISO/IEC 9805-1:1994), which has been technically revised.

ISO/IEC 9805 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — Protocol for the Commitment, Concurrency and Recovery service element*:

— *Part 1: Protocol specification*

— *Part 2: Protocol Implementation Conformance Statement (PICS) proforma*

Annexes A and B form an integral part of this part of ISO/IEC 9805.

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Introduction

This Recommendation | International Standard is one of a set of Recommendations | International Standards produced to facilitate the interconnection of information processing systems. It is related to other Recommendation | International Standards in the set as defined by the Reference Model for Open Systems Interconnection (see ITU-T Rec. X.200 | ISO/IEC 7498-1). The Reference Model subdivides the area of standardization for interconnection into a series of layers of specification, each of manageable size.

The goal of Open Systems Interconnection is to allow, with a minimum of technical agreement outside the interconnection standards, the interconnection of information processing systems:

- from different manufacturers;
- under different managements;
- of different levels of complexity; and
- of different technologies.

This Recommendation | International Standard specifies the protocol for the application-service-element for Commitment, Concurrency, and Recovery (CCR). These services are intended to be applicable to a wide range of application-process communication requirements.

This Recommendation | International Standard specifies CCR Protocol Version 2. The 1990 edition of ISO/IEC 9805 specified CCR protocol Version 1. The 1993/1994 editions of this Recommendation | International Standard specified both CCR protocol Version 1 and CCR protocol Version 2, for the static commitment functional unit only.

The CCR protocol specification consists of the following main components:

- a) the specification of the CCR APDUs using Abstract Syntax One (ASN.1, ITU-T Rec. X.680 | ISO/IEC 8824-1);
- b) the elements of procedure for issuing CCR service indication and confirm primitives to the CCR service-user when CCR APDUs are received and for the sending of CCR APDUs when CCR service request and indication primitives are received from the CCR service-user;
- c) the CCR protocol machine specified in terms of a state table; and
- d) the presentation services (see ITU-T Rec. X.216 | ISO/IEC 8822) used for sending and receiving CCR APDUs.

The CCR protocol shares the presentation-service with other application-service-elements.

The requirement to provide support for CCR together with other application-service-elements is satisfied by reference to this Recommendation | International Standard.

Annex A contains the definitions of the structure of the CCR APDUs.

Annex B describes how the CCR can be used in combination with other ASEs that use the presentation service in a way that is not compatible with the use of the presentation service by CCR as specified in the body of this Recommendation | International Standard.

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

**INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION –
 PROTOCOL FOR THE COMMITMENT, CONCURRENCY AND RECOVERY
 SERVICE ELEMENT: PROTOCOL SPECIFICATION**

1 Scope

This Recommendation | International Standard is to be applied by reference from other specifications. This is done within such specifications by reference to the CCR services defined in ITU-T Rec. X.851 | ISO/IEC 9804. A reference to a CCR service invokes the procedures of this Recommendation | International Standard to cause external effects.

This Recommendation | International Standard specifies, in clause 9, a use of the ACSE, Presentation and Session services to carry the CCR semantics. This “reference” mapping can be used whenever the use of these services does not conflict with the user made by other ASEs or ASOs that are using the same association. Annex B defines how a different use of supporting services may be specified, for use where the reference mapping is inappropriate.

This Recommendation | International Standard specifies the static and dynamic conformance requirements for systems implementing these procedures. It does not contain tests which can be used to demonstrate conformance.

This edition of this Recommendation | International Standard specifies CCR protocol Version 2, which makes use of the Session Data Separation functional unit to protect data not belonging to the CCR atomic action. The 1990 edition of ISO/IEC 9805 specified CCR protocol Version 1. The 1993/1994 edition of this Recommendation | International Standard specified both CCR protocol Version 1 and CCR protocol Version 2, for the static commitment functional unit only.

This International Standard specifies the protocol elements that support the following functional units:

- a) static commitment;
- b) dynamic commitment;
- c) read only;
- d) one-phase commitment;
- e) cancel; and
- f) overlapped recovery.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*.
- ITU-T Recommendation X.207 (1993) | ISO/IEC 9545:1994, *Information technology – Open Systems Interconnection – Application layer structure*.
- ITU-T Recommendation X.210 (1993) | ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model : Conventions for the definition of OSI services*.

- ITU-T Recommendation X.215 (1995) | ISO/IEC 8326:1996, *Information technology – Open Systems Interconnection – Session service definition.*
- ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition.*
- ITU-T Recommendation X.217 (1995) | ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the association control service element.*
- ITU-T Recommendation X.227 (1995) | ISO/IEC 8650-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented protocol for the association control service element: Protocol specification.*
- ITU-T Recommendation X.650 (1996) | ISO/IEC 7498-3:1997, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing.*
- ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*
- ITU-T Recommendation X.680 (1994)/Amd. 1 (1995) | ISO/IEC 8824-1:1995/Amd. 1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation – Amendment 1: Rules of extensibility.*
- Technical Corrigendum (1997) to ITU-T Recommendation X.680 (1994)/Amd. 1 (1995) | ISO/IEC 8824-1:1995/Amd. 1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation – Amendment 1: Rules of extensibility.*
- ITU-T Recommendation X.690 (1994) | ISO/IEC 8825-1:1995, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).*
- ITU-T Recommendation X.851 (1997) | ISO/IEC 9804:1998, *Information technology – Open Systems Interconnection – Service definition for the commitment, concurrency and recovery service element.*

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3 Definitions

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3.1 Reference model definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.200 | ISO/IEC 7498-1:

- a) Application Layer;
- b) application association; association;
- c) application-process;
- d) application-entity;
- e) presentation-service;
- f) presentation-connection;
- g) session-service; and
- h) session-connection.

3.2 Naming and addressing definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.650 | ISO/IEC 7498-3:

- a) application-process title;
- b) application-entity qualifier;
- c) application-entity title.

3.3 Service conventions definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.210 | ISO/IEC 10731:

- a) service-provider;
- b) service-user;
- c) confirmed service;
- d) non-confirmed service;
- e) primitive;
- f) request (primitive);
- g) indication (primitive);
- h) response (primitive); and
- i) confirm (primitive).

3.4 Presentation service definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.216 | ISO/IEC 8822:

- a) abstract syntax;
- b) abstract syntax name;
- c) defined context set;
- d) presentation context; and
- e) presentation data value.

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3.5 ACSE service definitions

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This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.217 | ISO/IEC 8649:

- a) association-initiator; and
- b) association-responder.

3.6 Application Layer Structure definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.207 | ISO/IEC 9545:

- a) application-entity-invocation;
- b) application-service-element;

3.7 CCR service definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.851 | ISO/IEC 9804:

- 1) acceptor;
- 2) application failure;
- 3) atomic action;
- 4) atomic action branch identifier; branch identifier;
- 5) atomic action branch; branch;
- 6) atomic action data;
- 7) atomic action graph;
- 8) atomic action identifier;

- 9) atomic action initiator;
- 10) atomic action owner;
- 11) atomicity;
- 12) begin-tree; atomic action begin-tree
- 13) bound data;
- 14) branch-initiator; atomic action branch-initiator;
- 15) branch-responder; atomic action branch-responder;
- 16) CCR service-provider;
- 17) CCR service-user;
- 18) commit coordinator;
- 19) commit-decider;
- 20) commit-subordinate;
- 21) commit-superior;
- 22) commit-tree; atomic action commit-tree;
- 23) communication failure;
- 24) compensating action;
- 25) concurrency control;
- 26) confirmation of commitment;
- 27) connected graph;
- 28) consistency;
- 29) continuing two-phase branch; continuing two-phase neighbour;
- 30) distributed application;
- 31) doubt period;
- 32) durability;
- 33) final state;
- 34) graph;
- 35) heuristic decision;
- 36) initial state;
- 37) intermediate;
- 38) intermediate state;
- 39) interrupted branch;
- 40) isolation;
- 41) leaf;
- 42) local commitment procedures;
- 43) local rollback procedures;
- 44) mixed heuristic situation; mixed situation;
- 45) neighbour (of a node in a graph);
- 46) neighbourhood (of a node);
- 47) node; CCR node;
- 48) non-reference mapping;
- 49) order of commitment of an atomic action branch; order of commitment;
- 50) phase I;
- 51) phase II;
- 52) presumed rollback;
- 53) ready signal;
- 54) ready-to-commit state;
- 55) recovery of an atomic action branch; recovery;
- 56) recovery responsibility for an atomic action branch; recovery responsibility;
- 57) reference mapping;
- 58) referencing specification;
- 59) requesting neighbourhood;
- 60) requestor;
- 61) rollback of an atomic action branch; rollback;
- 62) root;
- 63) subordinate of a node;
- 64) subordinate of an arc;
- 65) subordinate subtree;
- 66) subtree (of a node);
- 67) superior of a node (in a rooted tree);
- 68) superior of an arc (in a rooted tree);
- 69) tree;
- 70) user-ASE.

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3.8 CCR protocol specification definitions

For the purposes of this Recommendation | International Standard, the following definitions apply.

3.8.1 accepting CCR protocol machine: The CCR protocol machine whose service-user is the acceptor for a particular CCR service.

3.8.2 CCR protocol machine: The protocol machine of the CCR application-service-element specified in this Recommendation | International Standard.

3.8.3 requesting CCR protocol machine: The CCR protocol machine whose service-user is the requestor for a particular CCR service.

4 Abbreviations

4.1 Data units

APDU application-protocol-data-unit

4.2 Types of application-protocol-data-units

The following abbreviations have been given to the application-protocol-data-units defined in this Protocol Specification:

C-INITIALIZE-RI

C-INITIALIZE-RC

C-BEGIN-RI

C-BEGIN-RC

C-PREPARE-RI

C-READY-RI

C-COMMIT-RI

C-COMMIT-RC

C-ROLLBACK-RI

C-ROLLBACK-RC

C-CANCEL-RI

C-NOCHANGE-RI

C-NOCHANGE-RC

C-RECOVER-RI

C-RECOVER-RC

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4.3 Other abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

ACSE Association Control Service Element

AE application-entity

AEI application-entity invocation

AP application-process

APDU application-protocol-data-unit

ASE application-service-element

ASN.1 Abstract Syntax Notation One

CCR Commitment, Concurrency, and Recovery application-service-element

CCRPM CCR protocol machine

cnf	confirm primitive
ind	indication primitive
OSI	Open Systems Interconnection
req	request primitive
rsp	response primitive

5 Conventions

5.1 This Protocol Specification employs a tabular presentation of its APDU fields. In clause 7, tables are presented for each CCR APDU. Each field is summarized using the following notation:

M	Presence is Mandatory
O	Presence is CCRPM Option
U	Presence is CCR service-user option
req	Source is the related request primitive
ind	Sink is the related indication primitive
rsp	Source is the related response primitive
cnf	Sink is the related confirm primitive
CCRPM	Source or sink is the CCRPM

5.2 The structure of each CCR APDU is specified in Annex A using the abstract syntax notation of ASN.1 (see ITU-T Rec. X.680 | ISO/IEC 8824-1).

5.3 CCR allows the concatenation of some of its APDUs. In clause 11 the allowed concatenations are specified.

6 Overview of the CCR protocol [ISO/IEC 9805-1:1998](https://standards.iteh.ai/catalog/standards/sist/958f219d-a954-4e14-8471-85a546bde332/iso-iec-9805-1-1998)

6.1 Service support

The protocol specified in this Recommendation | International Standard supports the services defined in ITU-T Rec. X.851 | ISO/IEC 9804. These services are listed in Table 1.

Table 1 – CCR services

Service	Type	Requestor
C-INITIALIZE	Confirmed	Association initiator
C-BEGIN	Optionally confirmed	Branch-initiator
C-PREPARE	Non-confirmed	Either CCR service-user
C-READY	Non-confirmed	Either CCR service-user
C-COMMIT	Confirmed	Commit-superior
C-ROLLBACK	Confirmed	Either CCR service-user
C-NOCHANGE	Optionally confirmed	Either CCR service-user
C-CANCEL	Non-confirmed	Either CCR service-user
C-RECOVER	Confirmed or Optionally confirmed	Commit-superior or Commit-subordinate
C-P-ERROR	Provider-initiated	–

6.2 Constraints on ACSE services

6.2.1 An application-entity Invocation (AEI) establishes an association to exchange CCR APDUs with another AEI by using the A-ASSOCIATE service of ACSE (see ITU-T Rec. X.217 | ISO/IEC 8649).

6.2.2 When establishing the association, the following Presentation and Session Requirements must be specified on the A-ASSOCIATE service:

- Presentation kernel functional unit;
- Session kernel functional unit;
- Session typed data functional unit;
- Session minor synchronize functional unit;
- Session resynchronize functional unit;
- Session data separation functional unit;

6.2.3 When establishing the association, the following optional parameters of the ACSE A-ASSOCIATE service must be specified:

- a) Calling AP title;
- b) Calling AE qualifier;
- c) Responding AP title;
- d) Responding AE qualifier.

6.2.4 The ACSE User information on an A-ASSOCIATE request shall contain the C-INITIALIZE-RI APDU. The ACSE User information on an A-ASSOCIATE response shall contain the C-INITIALIZE-RC APDU.

6.3 Use of the presentation service

6.3.1 CCR uses the following presentation (see ITU-T Rec. X.216 | ISO/IEC 8822) services:

- P-DATA;
- P-TYPED-DATA; [ISO/IEC 9805-1:1998](https://standards.iteh.ai/catalog/standards/sist/958f219d-a954-4e14-8471-85a546bde332/iso-iec-9805-1-1998)
- P-SYNC-MINOR; [85a546bde332/iso-iec-9805-1-1998](https://standards.iteh.ai/catalog/standards/sist/958f219d-a954-4e14-8471-85a546bde332/iso-iec-9805-1-1998)
- P-RESYNCHRONIZE(abandon).

6.3.2 CCR APDUs are passed in the User Data parameters of the above presentation services as one or more presentation data values. The value of the ASN.1 data type for each CCR APDU is specified in Annex A. If more than one ASN.1 data type is sent, a corresponding number of presentation data values are included.

6.3.3 If other presentation data values are present on a presentation service primitive, the referencing specification shall specify sequencing rules. These rules shall ensure that the CCR semantics are maintained and comply with the concatenation and mapping rules specified in clauses 9 and 10.

NOTE – The use of presentation-service parameters other than User Data is specified in clause 9 .

6.3.4 It is the responsibility of the CCR service-user to control the presentation contexts available in the defined context set of the underlying presentation-connection.

6.4 Relationship to the session-service and the transport-service

6.4.1 The session functional units required for the session-connection that supports the presentation-connection (that in turn supports the association) are determined by the A-ASSOCIATE service requestor and acceptor. They accomplish this using the Session Requirements parameter on the A-ASSOCIATE primitives. The required session functional units are given in 6.2.

6.4.2 The rules of the session-service affect the operation of the CCRPM and its service-user. The CCR service-user must be aware of these constraints. This Protocol Specification assumes that a local mechanism enforces them. For example, it is the responsibility of the CCR service-user to control the possession of the available session tokens.

6.4.3 CCR requires use of session unlimited user data (see ITU-T Rec. X.215 | ISO/IEC 8326).

6.5 Operation of the CCRPM

6.5.1 The protocol specification for CCR is presented in this Recommendation | International Standard as a protocol machine. This protocol machine is referred to as the CCR Protocol Machine (CCRPM).

6.5.2 A CCRPM is used for a protocol exchange sequence for one atomic action branch on an existing association. A CCRPM is also used for a sequence of atomic action branches in which the completion (commitment or rollback) of one overlaps with the beginning of the next one. The procedures of a CCRPM are performed in cooperation with the overall CCR service-user. The CCRPM shares the presentation-connection that supports the association with other ASEs.

6.5.3 A CCR service primitive is issued by a CCR service-user within a sequence of application or presentation service primitives on a single association, as defined in ITU-T Rec. X.851 | ISO/IEC 9804.

6.5.4 The procedures specified in clause 7 are carried out as a result of the request and response primitives issued in conformance with the CCRPM State Table defined in clause 8 and as a result of the receipt of presentation service primitives carrying data values in the CCR presentation context. The parameters of the CCR service primitives are structured according to Annex A to produce CCR APDUs. These APDUs are transferred using the presentation-service according to the specification given in clauses 7, 9, and 11.

6.5.5 The value of a CCR APDU is transferred as a presentation data value from the CCR presentation context. The abstract syntax for data types transferred in this context are defined in Annex A by specifying the complete set of CCR APDUs using Abstract Syntax Notation One (see ITU-T Rec. X.680 | ISO/IEC 8824-1).

6.6 Rules of extensibility

For the C-INITIALIZE-RI APDU, a receiving CCRPM shall

- a) ignore any undefined element;
- b) where named bits are used, treat any bit as insignificant when no name is assigned to it.

7 Elements of procedures

The CCR protocol consists of the following procedures:

- a) initialization;
- b) begin branch;
- c) prepare ;
- d) signal readiness;
- e) order commitment;
- f) rollback;
- g) cancel;
- h) nochange completion;
- i) branch recovery;
- j) order commitment and begin new branch;
- k) rollback and begin new branch; and
- l) error.

The following subclauses describe these procedures. The descriptions include the specification of presentation service primitives normally used to carry CCR APDUs. However, for concatenated CCR APDUs, the presentation service mapping specified in clause 11 applies.

Figures 1 to 9 show the ASN.1 structure of the CCR APDUs. The complete ASN.1 module, containing these definition and those of the supporting datatypes, is in Annex A.

7.1 Initialization procedure

7.1.1 Purpose

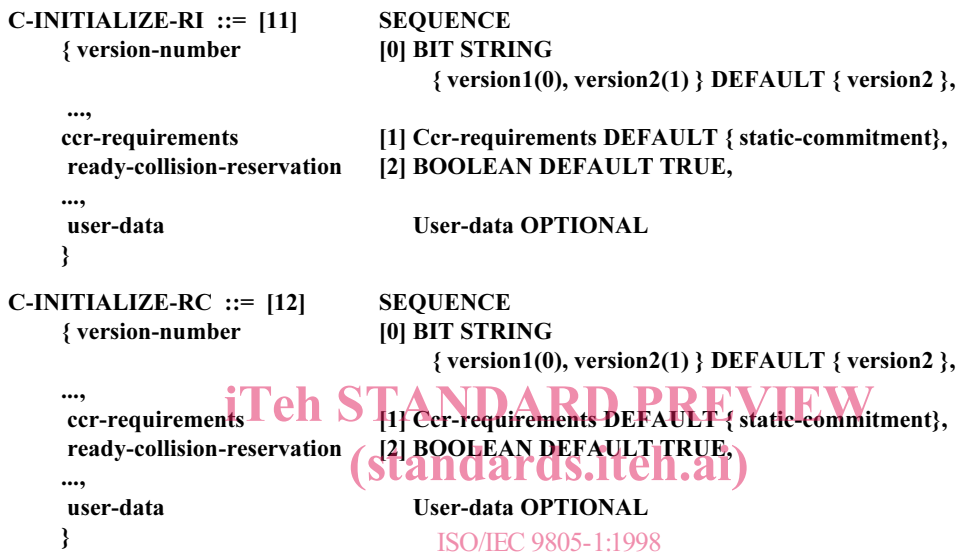
This procedure is used to negotiate the CCR version and which CCR functional units are available on the association. It supports the C-INITIALIZE service defined in X.851 | ISO/IEC 9804.

7.1.2 APDUs used

This procedure uses the following CCR APDUs:

- C-INITIALIZE-RI
- C-INITIALIZE-RC

The structure of these APDUs is shown in Figure 1.



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Figure 1 – C-INITIALIZE APDUs

The C-INITIALIZE-RI APDU fields are listed in Table 2. The C-INITIALIZE-RC APDU fields are listed in Table 3.

Table 2 – C-INITIALIZE-RI field

Field name	Presence	Source	Sink
version-number	M	CCRPM	CCRPM
ccr-requirements	M	req	ind
ready-collision-reservation	U	req	ind
user-data	U	req	ind

Table 3 – C-INITIALIZE-RC field

Field name	Presence	Source	Sink
version-number	M	CCRPM	CCRPM
ccr-requirements	M	req	ind
ready-collision-reservation	U	req	ind
user-data	U	req	ind

7.1.3 Procedure operation

The procedure is performed concurrently with the A-ASSOCIATE procedure (see ITU-T Rec. X.217 | ISO/IEC 8649) when the association will be used for CCR. The procedure is driven by the following events:

- a) C-INITIALIZE request primitive from the requestor;
- b) C-INITIALIZE-RI APDU received by the accepting CCRPM;
- c) C-INITIALIZE response primitive from the acceptor; and
- d) C-INITIALIZE-RC APDU received by the CCRPM of the requestor.