

Implementation of
ISO/IEC 9805-1:1994

Information Technology — Open Systems Interconnection — Protocol for the Commitment, Concurrency and Recovery service element: Protocol Specification

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National foreword

This British Standard reproduces verbatim ISO/IEC 9805-1:1994 and implements it as the UK national standard.

This British Standard supersedes BS ISO/IEC 9805:1990 which is withdrawn.

This British Standard is published under the direction of the Information Systems Technology Assembly whose Technical Committee IST/21 has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international committee any enquiries on interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO/IEC title page, pages ii to vi, pages 1 to 51 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

**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 de validation d'engagement,
de concurrence et de reprise: Spécification du protocole*



Reference number
ISO/IEC 9805-1:1994(E)

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Descriptors: Data processing, information interchange, network interconnection, open systems interconnection, application layer, communication procedure, control procedures, protocols, specifications.

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 21, *Open systems interconnection, data management and open distributed processing*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.852.

This second edition cancels and replaces the first edition (ISO 9805:1990), and is a consolidation of the first edition, Amendment 2 and Technical corrigenda 1 and 2.

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*.

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

Annex C is for information only.

Introduction

This Recommendation | International Standard is one of a set of Recommendation | 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 (CCITT Rec. X.200 | ISO 7498). 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 1 and CCR Protocol Version 2.

The CCR protocol specification consists of the following main components:

- a) the specification of the CCR APDUs using Abstract Syntax One (ASN.1, CCITT Rec. X.208 | ISO/IEC 8824);
- 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 (CCITT Rec. X.216 | ISO 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 the transfer of CCR APDUs as the values of a special parameter of another referencing application-service element. Such an application-service-element is called a cooperating main service.

Annex C provides tutorial information on the negotiation of CCR protocol version with an implementation that supports only CCR protocol version 1.

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 applies whenever the use of CCR services does not encompass any communication activity which makes direct or indirect use of the session activity management services defined in CCITT Rec. X.215 | ISO 8326. It can be used inside a session activity, and on a session-connection where the session activity functional unit is not in use. It can also be applied when the S-ACTIVITY service is used through the mechanisms of Annex B.

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 Recommendation | International Standard specifies the following protocol versions:

- a) Protocol Version 1 which does not make use of the Session Data Separation functional unit.
- b) Protocol Version 2 which makes use of the Session Data Separation functional unit to protect data not belonging to the CCR atomic action.

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 Telecommunications Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.207 (1993) | ISO/IEC 9545:1993, *Information technology — Open Systems Interconnection — Application Layer structure*.
- ITU-T Recommendation X.210 (1993) | ISO/IEC 10731:1993, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*.
- ITU-T Recommendation X.851 (1993) | ISO/IEC 9804:1993, *Information technology — Open Systems Interconnection — Service definition for the Commitment, Concurrency and Recovery service element*.

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1988), *Reference model of open systems interconnection for CCITT applications*.
ISO 7498:1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model*.
- CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1)*.
ISO/IEC 8824:1990, *Information technology — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1)*.
- CCITT Recommendation X.209 (1988), *Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)*.
ISO/IEC 8825:1990, *Information technology — Open Systems Interconnection — Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*.
- CCITT Recommendation X.215 (1988), *Session service definition for open systems interconnection for CCITT applications*.
ISO 8326:1987, *Information processing systems — Open Systems Interconnection — Basic connection oriented session service definition*.
ISO 8326:1987/Add.2:..., *Information processing systems — Open Systems Interconnection — Basic connection oriented session service definition ADDENDUM 2: Incorporation of unlimited user data*¹⁾.
- CCITT Recommendation X.216 (1988), *Presentation service definition for open systems interconnection for CCITT applications*.
ISO 8822:1988, *Information processing systems — Open Systems Interconnection — Connection oriented presentation service definition*.
- CCITT Recommendation X.217 (1992), *Service definition for the Association Control Service Element*.
ISO 8649:..., *Information processing systems — Open Systems Interconnection — Service definition for the Association Control Service Element*¹⁾.
- CCITT Recommendation X.650 (1992), *Open Systems Interconnection (OSI) — Reference model for naming and addressing*.
ISO 7498-3:1989, *Information processing systems — Open Systems Interconnection — Basic Reference Model — Part 3: Naming and addressing*.

2.3 Additional references

- ISO 8326:1987/Amd.4:..., *Information processing systems — Open Systems Interconnection — Basic connection oriented session service definition AMENDMENT 4: Additional Synchronization Functionality*¹⁾.

¹⁾ Presently at the stage of draft.

ISO 8822:1988/Amd.5:..., *Information processing systems — Open Systems Interconnection — Connection oriented presentation service definition AMENDMENT 5: Additional Session Synchronization Functionality to the Presentation Service User*²⁾.

3 Definitions

3.1 Reference model definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.200 | ISO 7498:

- 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 CCITT Rec. X.650 | ISO 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 CCITT Rec. X.216 | ISO 8822:

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

3.5 ACSE service definitions

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

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

²⁾ Presently at the stage of draft.

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;
- c) multiple association control function;
- d) single association control function; and
- e) single association object.

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; branch;
- 5) atomic action branch identifier; branch identifier;
- 6) atomic action data;
- 7) atomic action identifier;
- 8) atomic action tree;
- 9) atomicity;
- 10) bound data;
- 11) CCR service-provider;
- 12) CCR service-user;
- 13) commitment of an atomic action branch; commitment;
- 14) communication failure;
- 15) concurrency control;
- 16) cooperating main service;
- 17) distributed application;
- 18) doubt period;
- 19) durability;
- 20) final state;
- 21) heuristic decision;
- 22) initial state;
- 23) intermediate CCR service-user; intermediate;
- 24) intermediate state;
- 25) interrupted branch;
- 26) isolation;
- 27) leaf CCR service-user; leaf;
- 28) local commitment procedures;
- 29) local rollback procedures;
- 30) master CCR service-user; master;
- 31) offer of commitment of an atomic action branch; offer of commitment;
- 32) order of commitment of an atomic action branch; order of commitment;
- 33) phase I;
- 34) phase II;
- 35) presumed rollback;

- 36) recovery control;
- 37) recovery responsibility for an atomic action branch; recovery responsibility;
- 38) referencing specification;
- 39) requestor;
- 40) rollback of an atomic action branch; rollback;
- 41) subordinate of an atomic action branch; subordinate; and
- 42) superior of an atomic action branch; superior.

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 (when using CCR Protocol Version 2)
 C-INITIALIZE-RC (when using CCR Protocol Version 2)
 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-RECOVER-RI
 C-RECOVER-RC

4.3 Other abbreviations

The following abbreviations are used in this Protocol Specification.

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 (CCITT Rec. X.208 | ISO/IEC 8824).

5.3 CCR allows the concatenation of some of its APDUs. In clause 11 an ASN.1-like notation is used to express the allowed concatenations.

6 Overview of the CCR protocol

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-BEGIN	Optionally confirmed	Superior
C-PREPARE	Non-confirmed	Superior
C-READY	Non-confirmed	Subordinate
C-COMMIT	Confirmed	Superior
C-ROLLBACK	Confirmed	Superior or subordinate
C-RECOVER	Confirmed or Optionally confirmed	Superior Subordinate

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 (CCITT 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 major synchronize functional unit (when using CCR Protocol Version 1)

Session minor synchronize functional unit

Session resynchronize functional unit

Session data separation functional unit (when using CCR Protocol Version 2)

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 If CCR Protocol Version 2 is proposed for use on the association, the ACSE User information on an A-ASSOCIATE request shall contain the C-INITIALIZE-RI APDU. If CCR Protocol Version 2 has been proposed for use, and the proposal has been accepted, 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 (CCITT Rec. X.216 | ISO 8822) services:

P-DATA

P-TYPED-DATA

P-SYNC-MAJOR (when using CCR Protocol Version 1)

P-SYNC-MINOR

P-RESYNCHRONIZE(restart) (when using CCR Protocol Version 1)

P-RESYNCHRONIZE(abandon) (when using CCR Protocol Version 2)

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, 10 and 11.

NOTE The use of presentation-service parameters other than User Data is specified in clauses 9 and 10.

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 If CCR Protocol Version 1 is being used and the Transport-expedited service is used by the session layer, the CCR service-user

- a) shall respond to a C-BEGIN indication with a C-BEGIN response; and
- b) following a C-BEGIN request, shall not issue C-ROLLBACK request until after receipt of a C-BEGIN confirmation.

If the Transport-expedited service is not used by the session layer, these restrictions do not apply.

NOTE With CCR Protocol Version 1, the use of the session resynchronization service for C-ROLLBACK is liable to cause purging of user data outside the atomic action. If the Transport-expedited service is used by session and the above restrictions are not followed, the C-BEGIN can be purged and user-data preceding it. This will not occur if CCR Protocol Version 2 is used.

6.4.4 CCR requires use of session unlimited user data (see CCITT Rec. X.215 | ISO 8326:1987/Add.2).

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 co-operation 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 (CCITT Rec. X.208 | ISO/IEC 8824).

6.6 Rules of extensibility for CCR Protocol Version 2

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, if CCR Protocol Version 2 is being used;
- b) begin branch;
- c) prepare subordinate;
- d) offer commitment;
- e) order commitment;
- f) rollback;
- g) branch recovery;
- h) order commitment and begin new branch; and
- i) rollback and begin new branch.

7.0.1 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.

Figure 1 to Figure 7 show the ASN.1 structure of the CCR APDUs used with CCR Protocol Version 2. The complete ASN.1 module, containing these definition and those of the supporting datatypes, is in Annex A. Annex A also contains the ASN.1 module defining the CCR APDUs and datatypes used with CCR Protocol Version 1.

7.1 Association establishment procedure

7.1.1 Purpose

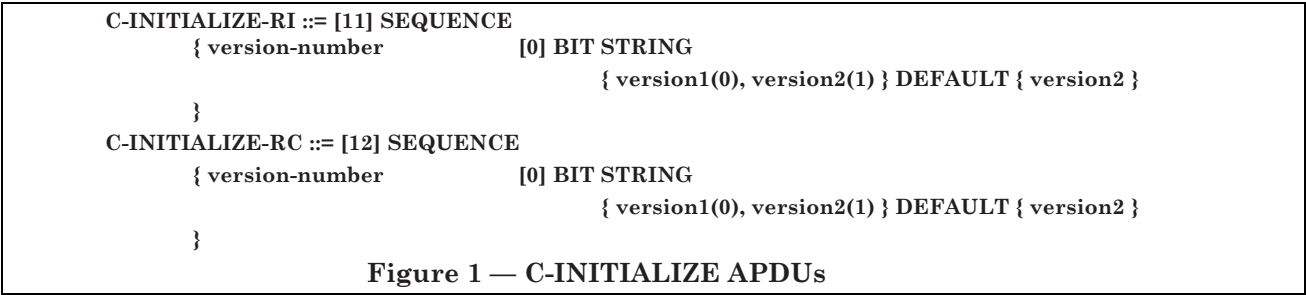
This procedure is used to negotiate the CCR version to be used between two CCR protocol machines over the association. This procedure is only used by CCRPMs that support CCR Protocol Version 2.

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.



The C-INITIALIZE-RI APDU field is listed in Table 2. The C-INITIALIZE-RC APDU field is listed in Table 3.

Table 2 — C-INITIALIZE-RI field

Field name	Presence	Source	Sink
version-number	M	CCRPM	CCRPM

Table 3 — C-INITIALIZE-RC field

Field name	Presence	Source	Sink
version-number	M	CCRPM	CCRPM

The version-number parameter on the C-INITIALIZE-RI is used to indicate which versions of CCR are being proposed for use on this association.

The version-number parameter on the C-INITIALIZE-RC has two possible uses. If the association is accepted, the parameter shall indicate the version of CCR which will be used on this association. If the association is rejected, the parameter shall indicate which versions of CCR are available for use on a future association.

7.1.3 Procedure operation

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

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

When interworking with CCR Protocol Version 1, the last event does not occur and the procedure is completed by:

- e) A-ASSOCIATE confirm primitive with no CCR APDU in the User information.

7.1.3.1 A-ASSOCIATE request primitive

When an A-ASSOCIATE request is made and the Application Context contains the CCR ASE, then the CCRPM generates a C-INITIALIZE-RI APDU, which is carried in the user information parameter of the A-ASSOCIATE request.