INTERNATIONAL STANDARD

ISO/IEC 9805

First edition
1990-11-15

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

Technologies de l'information — Interconnexion de systèmes ouverts — Spécification du protocole pour l'élément de service d'engagement, concurrence et reprise

Reference number
ISO/IEC 9805:1990(E)

Contents

Foreword v

Introduction vi

1 Scope 1

2 Normative references 1

3 Definitions 1

3.1 Reference model definitions 1

3.2 Naming and addressing definitions 2

3.3 Service conventions definitions 2

3.4 Presentation service definitions 2

3.5 ACSE service definitions 2

3.6 Application Layer Structure definitions 2

3.7 CCR service definitions 2

3.8 CCR protocol specification definitions 3

4 Symbols and abbreviations 3

4.1 Data units 3

4.2 Types of application-protocol-data-units 3

4.3 Other abbreviations 3

5 Conventions 3

6 Overview of the CCR protocol 3

6.1 Service support 3

6.2 Constraints on ACSE services 4

6.3 Use of the presentation service 4

6.4 Relationship to the session-service and the transport-service. 4

6.5 Operation of the CCRPM 5

7 Elements of procedures 6

7.1 Begin branch procedure 6

7.2 Prepare subordinate procedure 7

7.3 Offer commitment procedure 8

7.4 Order commitment 9

7.5 Rollback 10

7.6 Branch recovery procedure 11

7.7 Order commitment and begin branch procedure 13

7.8 Rollback and begin branch procedure 14

8 CCRPM State Table 16

8.1 General 16

8.2 Incoming events 16

8.3 Outgoing events 16

8.4 Specific actions 16

8.5 Predicates 16

8.6 Enablements 16

8.7 Variables 17

8.8 Notation 17

8.9 Conventions 17

8.10 Actions to be taken by the CCRPM 17

8.11 Changes to atomic action data 18

9 Mapping to the presentation service 26

9.1 Begin branch 26

9.2 Prepare subordinate 27

9.3 Offer commitment 27

9.4 Order commitment 27

9.5 Rollback 27

9.6 Branch recovery 27

10 Concatenations and mappings 27

10.1 Mapping precedence 28

10.2 Allowable concatenations 28

11 Precedence 29

12 Conformance 29

12.1 Statement requirements 29

12.2 Static conformance requirements 29

12.3 Presentation transfer syntax 30

12.4 Bound data and atomic action data 30

12.5 Dynamic conformance requirements 30

Annexes

A Definition of CCR datatypes 31

B Use of CCR APDUs by a cooperating main service 33

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 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

Annexes A and B form an integral part of this International Standard.

Introduction

This International Standard is one of a set of International Standards produced to facilitate the interconnection of information processing systems. It is related to other International Standards in the set as defined by the Reference Model for Open Systems Interconnection (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 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.

The CCR protocol specification consists of the following main components:

a) the specification of the CCR APDUs using Abstract Syntax One (ASN.1, ISO 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 (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 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 co-operating main service.

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

1 Scope

This 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 ISO/IEC 9804. A reference to a CCR service invokes the procedures of this International Standard to cause external effects.

This 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 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 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.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7498:1984, *Information processing systems – Open Systems Interconnection – Basic Reference Model.*

ISO 7498-3:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 3: Naming and addressing.*

ISO 8326:1987, *Information processing systems – Open Systems Interconnection – Basic connection oriented session service definition.*

ISO 8326:1987/Add.2:—[1], *Information processing systems – Open Systems Interconnection – Basic connection oriented session service definition – Addendum 2: Unlimited user data.*

ISO/TR 8509:1987, *Information processing systems – Open Systems Interconnection – Service Conventions.*

ISO 8649:1988, *Information processing systems – Open Systems Interconnection – Service definition for the Association Control Service Element.*

ISO 8822:1988, *Information processing systems – Open Systems Interconnection – Connection oriented presentation service definition.*

ISO 8824:1990, *Information processing systems – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1).*

ISO 8825:1990, *Information processing systems – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*

ISO/IEC 9545:1989, *Information technology – Open Systems Interconnection – Application Layer structure.*

ISO/IEC 9804:1990, *Information technology – Open Systems Interconnection – Service definition for the Commitment, Concurrency and Recovery service element.*

3 Definitions

3.1 Reference model definitions

This International Standard makes use of the following terms defined in ISO 7498:

a) Application Layer;

b) application association; association;

c) application-process;

d) application-entity;

e) presentation-service;

1) To be published.

f) presentation-connection;

g) session-service; and

h) session-connection.

3.2 Naming and addressing definitions

This International Standard makes use of the following terms defined in ISO 7498-3:

a) application-process title;

b) application-entity qualifier;

c) application-entity title;

3.3 Service conventions definitions

This International Standard makes use of the following terms defined in ISO/TR 8509:

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 International Standard makes use of the following terms defined in 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 International Standard makes use of the following terms defined in ISO 8649:

a) association-initiator; and

b) association-responder.

3.6 Application Layer Structure definitions

This International Standard makes use of the following terms defined in 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 International Standard makes use of the following terms defined in 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 purpose of this 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 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 Symbols and 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 International Standard.

C-BEGIN-RI
C-BEGIN-RC
C-PREPARE-RI
C-READY-RI
C-ROLLBACK-RI
C-ROLLBACK-RC
C-COMMIT-RI
C-COMMIT-RC
C-RECOVER-RI
C-RECOVER-RC

4.3 Other abbreviations

The following abbreviations are used in this International Standard.

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 International Standard 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 (ISO 8824).

5.3 CCR allows the concatenation of some of its APDUs. In clause 9 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 International Standard supports the services defined in ISO/IEC 9804. These services are listed in table 1.

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 (ISO 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

session minor synchronize functional unit

session resynchronize 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

6.3 Use of the presentation service

6.3.1 CCR uses the following presentation (ISO 8822) services:

P-DATA
P-TYPED-DATA
P-SYNC-MAJOR
P-SYNC-MINOR
P-RESYNCHRONIZE(restart)

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 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 International Standard 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 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.

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

NOTE — The use of the session resynchronize 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 preceeding it. It is expected that a future change to session will prevent this possibility and thus allow the removal of this requirement.

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

6.5 Operation of the CCRPM

6.5.1 The protocol specification for CCR is presented in this 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 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 10.

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 (ASN.1, ISO 8824).

7 Elements of procedures

The CCR protocol consists of the following procedures:

a) begin branch;

b) prepare subordinate;

c) offer commitment;

d) order commitment;

e) rollback;

f) branch recovery;

g) order commitment and begin new branch; and

h) rollback and begin new branch.

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 10 applies.

Figures 1 to 6 show the ASN.1 structure of the CCR APDUs. The complete ASN.1 module, containing these definitions and those of the supporting datatypes, is in annex A.

7.1 Begin branch procedure

7.1.1 Purpose

This procedure is used to begin a new atomic action branch between two CCR-service users. It supports the C-BEGIN service defined in ISO/IEC 9804.

7.1.2 APDUs used

The procedure uses the following CCR APDUs:

C-BEGIN-RI
C-BEGIN-RC

The structure of these APDUs is shown in figure 1.

The C-BEGIN-RI APDU fields are listed in table 2. The C-BEGIN-RC APDU field is listed in table 3.

7.1.3 Prerequisite requirements

7.1.3.1 For the requestor, the use of this procedure requires that no other atomic action branch is active on the association.

7.1.3.2 The requestor of the C-BEGIN request primitive shall be the owner of the session synchronize-minor token.

```
C-BEGIN-RI ::= [1] SEQUENCE
     {  atomic-action-identifier      [0] ATOMIC-ACTION-IDENTIFIER,
        branch-suffix                 [1] BRANCH-SUFFIX,
        user-data                         User-data    OPTIONAL
     }

C-BEGIN-RC ::= [2] SEQUENCE
     {  user-data                         User-data    OPTIONAL }
```

Figure 1 — C-BEGIN APDUs

Table 2 — C-BEGIN-RI fields

Field name	Presence	Source	Sink
atomic-action-identifier	M	req	ind
branch-suffix	M	req	ind
user-data	U	req	ind

Table 3 — C-BEGIN-RC field

Field name	Presence	Source	Sink
user-data	U	req	ind

7.1.4 Procedure operation

This procedure is driven by the following events:

a) C-BEGIN request primitive from the requestor;

b) C-BEGIN-RI APDU received by the accepting CCRPM;

c) C-BEGIN response primitive from the acceptor; and

d) C-BEGIN-RC APDU received by the requesting CCRPM.

The events c) and d) are optional and may occur later.

7.1.4.1 C-BEGIN request primitive

The requesting CCRPM forms a C-BEGIN-RI APDU from parameter values of the C-BEGIN request primitive. If the C-BEGIN-RI is not concatenated with other CCR APDUs, the CCRPM issues a P-SYNC-MINOR request primitive with the APDU as a data value of the primitive's User Data parameter. If the CCRPM concatenates the C-BEGIN-RI APDU with another CCR APDU, it issues the appropriate presentation service primitive as specified in clause 10, with the C-BEGIN-RI APDU as a data value in the user data parameter.

7.1.4.2 C-BEGIN-RI APDU

The accepting CCRPM receives a C-BEGIN-RI APDU from its peer as user data on a P-SYNC-MINOR indication primitive, if the APDU is unconcatenated. If the APDU is concatenated with other CCR APDUs, the C-BEGIN-RI APDU will be received as user data on the appropriate presentation primitive as specified in clause 10. In either case, the CCRPM issues a C-BEGIN indication primitive with parameter values derived from the APDU.

7.1.4.3 C-BEGIN response primitive

The accepting CCRPM forms a C-BEGIN-RC APDU from the parameter value of the C-BEGIN response primitive. If the C-BEGIN-RC is not concatenated with other CCR APDUs, the CCRPM issues a P-SYNC-MINOR response primitive with the APDU as a data value of the primitive's User Data parameter. If the CCRPM concatenates the C-BEGIN-RC APDU with another CCR APDU, it issues the appropriate presentation service primitive as specified in clause 10, with the C-BEGIN-RC APDU as a data value in the user data parameter.

7.1.4.4 C-BEGIN-RC APDU

The requesting CCRPM receives a C-BEGIN-RC APDU from its peer as user data on a P-SYNC-MINOR confirm primitive, if the APDU is unconcatenated. If the APDU is concatenated with other CCR APDUs, the C-BEGIN-RC APDU will be received as user data on the appropriate presentation primitive as specified in clause 10. In either case, the CCRPM issues a C-BEGIN confirm primitive with the parameter value derived from the APDU.

7.1.5 Use of the C-BEGIN-RI APDU fields

For the requesting CCRPM: the fields of the C-BEGIN-RI APDU are directly mapped from the corresponding parameters on the C-BEGIN request primitive as specified in table 4.

The C-BEGIN request includes the Branch Identifier - Superior's Name parameter on the request primitive. The parameter value is the requestor's AE title which was passed in the A-ASSOCIATE service used to establish the supporting association and is not mapped to a field of the C-BEGIN-RI APDU.

For the accepting CCRPM: the fields of the C-BEGIN-RI APDU are directly mapped to the corresponding parameters on the C-BEGIN indication primitive as specified in table 4.

The accepting CCRPM also includes the Branch Identifier - Superior's Name parameter on the indication primitive. The parameter value is the requestor's AE title passed in the A-ASSOCIATE service used to establish the supporting association.

7.1.6 Use of the C-BEGIN-RC APDU field

For the accepting and requesting CCRPM: the C-BEGIN-RC APDU field is directly mapped to and from the corresponding parameter on the C-BEGIN response and confirm primitives as specified in table 5.

Table 4 — Mapping of C-BEGIN req/ind parameters

APDU field name	Parameter name
atomic-action-identifier {masters-name}	Atomic Action Identifier - Master's Name
atomic-action-identifier {atomic-action-suffix}	Atomic Action Identifier - Suffix
—	Branch Identifier - Superior's Name
branch-suffix	Branch Identifier - Suffix
user-data	User Data

Table 5 —Mapping of C-BEGIN rsp/cnf parameter

APDU field name	Parameter name
user-data	User Data

7.1.7 Collisions

A collision of a C-BEGIN-RI APDU with another CCR APDU cannot occur.

NOTE — Collisions between two C-BEGIN-RI APDUs cannot occur because the CCR service-user must own the synchronize-minor token when issuing C-BEGIN request (except when issued with C-ROLLBACK or C-COMMIT). The requirement to own the token before issuing C-RECOVER request (except when replying to a C-RECOVER indication) makes collisions of C-BEGIN-RI APDUs and C-RECOVER-RI APDUs impossible.

7.2 Prepare subordinate procedure

7.2.1 Purpose

The prepare subordinate procedure is used by the superior to request that the subordinate complete processing for the atomic action branch and use the offer commitment procedure (see 7.3) to complete the atomic action branch. If offering commitment is not possible, the subordinate uses the rollback procedure (see 7.5) to force completion of the atomic action branch. The prepare subordinate procedure supports the C-PREPARE service defined in ISO/IEC 9804.

7.2.2 APDU used

The procedure uses the following CCR APDU.

C-PREPARE-RI

The structure of this APDU is shown in figure 2.

The C-PREPARE-RI APDU field is listed in table 6.

Table 6 — C-PREPARE-RI field

Field name	Presence	Source	Sink
user-data	U	req	ind

7.2.3 Prerequisite requirements

None.

7.2.4 Prepare subordinate procedure

This procedure is driven by the following events:

a) C-PREPARE request primitive from the requestor; and