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**Information technology — Open Systems  
Interconnection — Connection-mode  
protocol for the Application Service Object  
Association Control Service Element**

*Technologies de l'information — Interconnexion des systèmes ouverts —  
Protocole en mode connexion pour l'élément de service de contrôle  
d'association des objets de service d'application*

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Reference number  
ISO/IEC 15954:1999(E)



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 15954 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.227 bis.

This first edition of ISO/IEC 15954 cancels and replaces ISO/IEC 8650-1:1999 and its Amendment 1:1997 and Amendment 2:1998, of which it constitutes a technical revision.

Annexes A to D form a normative part of this International Standard. Annex E is for information only.

This document is a derivative of ISO/IEC 15954:1999

## Introduction

This Recommendation | International Standard is one of a set of ITU-T Recommendations | International Standards produced to facilitate the interconnection of information processing systems. It is related to other ITU-T Recommendations and 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 Opens 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 connection-mode protocol for the application service element for ASO-association control: the Association Control Service Element (ACSE). The protocol for ACSE connectionless mode service (A-UNIT-DATA) is specified in ITU-T Rec. X.237 *bis* | ISO/IEC 15955. The ACSE provides services for establishing and releasing associations. The ACSE protocol includes three optional functional units. One functional unit supports the exchange of information in support of authentication during association establishment. The second functional unit supports the negotiation of ASO-context during association establishment. The optional Higher Level Association functional unit provides for the facility to identify ASO-associations and transparently pass data to child ASOs and allows the ASO-context or the presentation context on an ASO-association to be modified during the lifetime of the association.

The fast-associate mechanism allows a session connection, including its embedded presentation connection and application association, to be established using a compressed form of the information that would otherwise be sent on the S-CONNECT exchange. The compressed form, called the upper layer context identifier, is a reference to an upper-layer context specification, which is a definition of the fields of the application, ACSE, presentation, and session protocols that would be sent on the full-form connect messages. The upper-layer context identifier may be parameterized to include values for variable fields allowed by the full form protocols for the upper layers.

Within the ACSE protocol, the addition is the definition of the construction of the User summary parameter of the P-CONNECT primitives from the semantics of the AARQ fields and the User summary parameter of the corresponding A-ASSOCIATE primitive.

This Recommendation | International Standard maintains compatibility with earlier editions of ACSE. This Recommendation | International Standard does not support X.410 mode nor Session Version 1.

This Recommendation | International Standard includes an annex that describes the protocol machine of ACSE in terms of a state table. This protocol machine is referred to as the Association Control Protocol Machine (ACPM).

The protocol defined in this Recommendation | International Standard is also governed by the use of the Presentation service (see ITU-T Rec. X.216 | ISO/IEC 8822).

## INTERNATIONAL STANDARD

## ITU-T RECOMMENDATION

# INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – CONNECTION-MODE PROTOCOL FOR THE APPLICATION SERVICE OBJECT ASSOCIATION CONTROL SERVICE ELEMENT

## 1 Scope

The ACSE supports two modes of communication: connection-mode and connectionless-mode. The ACSE service definition (see ITU-T Rec. X.217 *bis* | ISO/IEC 15953) includes both modes of communication. This Recommendation | International Standard only includes the connection mode of communication. This Recommendation | International Standard for the connectionless mode of communication is contained in ITU-T Rec. X.237 *bis* | ISO/IEC 15955.

This Recommendation | International Standard defines procedures that are applicable to instances of communication between systems which wish to interconnect in an open systems interconnection environment in a connection mode. This Recommendation | International Standard includes the Kernel functional unit that is used to establish and release ASO-associations. The Authentication functional unit provides additional facilities for exchanging information in support of authentication during association establishment without adding new services. The ACSE authentication facilities can be used to support a limited class of authentication methods. The ASO-context negotiation functional unit provides the additional facility for the recipient to select the ASO-context from a list offered by the initiator during association establishment. The optional Higher Level Association functional unit provides for the facility to identify ASO-associations and transparently pass data to child ASOs and allows the ASO-context or the presentation context on an ASO-association to be modified during the lifetime of the association.

This Recommendation | International Standard specifies:

- a) procedures for the transfer of information for ASO-association control and the authentication of ASOs and application-entities; and
- b) the abstract syntax for the representation of the ACSE APDUs.

The ACSE procedures are defined in terms of:

- a) the interactions among peer ACSE protocol machines through the use of Presentation services or supporting ACSE services; and
- b) the interaction between an ACSE protocol machine and its service-user.

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

## 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 this 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.215 (1995)/Amd.1 (1997) | ISO/IEC 8326:1996/Amd.1:1998, *Information technology – Open Systems Interconnection – Session service definition – Amendment 1: Efficiency enhancements.*
- ITU-T Recommendation X.215 (1995)/Amd.2 (1997) | ISO/IEC 8326:1996/Amd.2:1998, *Information technology – Open Systems Interconnection – Session service definition – Amendment 2: Nested connections functional unit.*
- ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition.*
- ITU-T Recommendation X.216 (1994)/Amd.1 (1997) | ISO/IEC 8822:1994/Amd.1:1998, *Information technology – Open Systems Interconnection – Presentation service definition – Amendment 1: Efficiency enhancements.*
- ITU-T Recommendation X.216 (1994)/Amd.2 (1997) | ISO/IEC 8822:1994/Amd.2:1998, *Information technology – Open Systems Interconnection – Presentation service definition – Amendment 2: Nested connections functional unit.*
- ITU-T Recommendation X.217 bis (1998) | ISO/IEC 15953:1999, *Information technology – Open Systems Interconnection – Service definition for the application service object – Association control service element.*
- ITU-T Recommendation X.225 (1995) | ISO/IEC 8327-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented session protocol: Protocol specification.*
- ITU-T Recommendation X.225 (1995)/Amd.1 (1997) | ISO/IEC 8327-1:1996/Amd.1:1998, *Information technology – Open Systems Interconnection – Connection-oriented session protocol: Protocol specification – Amendment 1: Efficiency enhancements.*
- ITU-T Recommendation X.225 (1995)/Amd.2 (1998) | ISO/IEC 8327-1:1996/Amd.2:1998, *Information technology – Open Systems Interconnection – Connection-oriented session protocol: Protocol specification – Amendment 2: Nested connections functional unit.*
- ITU-T Recommendation X.226 (1994) | ISO/IEC 8823-1:1994, *Information technology – Open Systems Interconnection – Connection-oriented presentation protocol: Protocol specification.*
- ITU-T Recommendation X.226 (1994)/Amd.1 (1997) | ISO/IEC 8823-1:1994/Amd.1:1998, *Information technology – Open Systems Interconnection – Connection-oriented presentation protocol: Protocol specification – Amendment 1: Efficiency enhancements.*
- ITU-T Recommendation X.226 (1994)/Amd.2 (1997) | ISO/IEC 8823-1:1994/Amd.2:1998, *Information technology – Open Systems Interconnection – Connection-oriented presentation protocol: Protocol specification – Amendment 2: Nested connections functional unit.*
- ITU-T Recommendation X.237 bis (1998) | ISO/IEC 15955:1999, *Information technology – Open Systems Interconnection – Connectionless protocol for the application service Object-Association control service element.*
- ITU-T Recommendation X.501 (1993) | ISO/IEC 9594-2:1995, *Information technology – Open Systems Interconnection – The Directory: Models.*
- ITU-T Recommendation X.650 (1996) | ISO/IEC 7498-3:1997, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing.*
- CCITT Recommendation X.660 (1992) | ISO/IEC 9834-1:1993, *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: General procedures.*
- CCITT Recommendation X.665 (1992) | ISO/IEC 9834-6 (1993), *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: Application processes and application entities.*
- 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.1:1996 *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation – Amendment 1: Rules of extensibility.*
- ITU-T Recommendation X.681 (1994) | ISO/IEC 8824-2:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*
- ITU-T Recommendation X.681 (1994)/Amd.1 (1995) | ISO/IEC 8824-2:1995/Amd.1:1996, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification – Amendment 1: Rules of extensibility.*
- ITU-T Recommendation X.682 (1994) | ISO/IEC 8824-3:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*
- ITU-T Recommendation X.683 (1994) | ISO/IEC 8824-4:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.*
- ITU-T Recommendation X.691 (1995) | ISO/IEC 8825-2:1996, *Information technology – ASN.1 Encoding Rules: Specification of Packed Encoding Rules (PER).*

## 2.2 Paired Recommendations | International Standards equivalent in technical content

- 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.800 (1991), *Security architecture for Open Systems Interconnection for CCITT applications.*  
ISO 7498-2:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 2: Security Architecture.*

## 2.3 Additional references

- ISO 6523:1984, *Data interchange – Structures for the identification of organizations.*

# 3 Definitions

## 3.1 Reference Model definitions

### 3.1.1 Basic Reference Model definitions

This Recommendation | International Standard is based on the concepts developed in ITU-T Rec. X.200 | ISO/IEC 7498-1 and makes use of the following terms defined in it:

- a) Application Layer;
- b) application-process;
- c) application-entity;
- d) application-service-element;
- e) application-protocol-data-unit;
- f) application-protocol-control-information;
- g) presentation-service;
- h) presentation-connection;
- i) concrete syntax;
- j) session-service;
- k) session-protocol; and
- l) session-connection.

### 3.1.2 Security architecture definitions

This Recommendation | International Standard makes use of the following term defined in CCITT Rec. X.800 | ISO 7498-2:

- password.

### 3.1.3 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;<sup>1)</sup>
- d) application-process invocation-identifier;
- e) application-entity invocation-identifier; and
- f) presentation address.

## 3.2 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) provider-initiated service;
- f) primitive;
- g) request (primitive);
- h) indication (primitive);
- i) response (primitive);
- j) confirm (primitive);
- k) submit (primitive); and
- l) deliver (primitive).

## 3.3 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) default context;
- d) defined context set;
- e) functional unit [presentation];
- f) presentation context;
- g) presentation data value.

<sup>1)</sup> As defined in ITU-T Rec. X.650 | ISO/IEC 7498-3, an application-entity title is composed of an application-process title and an application-entity qualifier. The ACSE protocol provides for the transfer of an application-entity title value by the transfer of its component values.

### 3.4 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) ASO-context;
- b) application-entity invocation;
- c) control function;
- d) application-service-object (ASO);
- e) ASO-association;
- f) ASO-association-identifier;
- g) ASO-invocation;
- h) ASOI-identifier;
- i) ASOI-tag;
- j) ASO-name;
- k) ASO-qualifier;
- l) ASO-title;
- m) child ASO; and
- n) parent ASO.

### 3.5 ACSE service definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.217 bis | ISO/IEC 15953:

- a) Association Control Service Element;
- b) ACSE service-user;
- c) ACSE service-provider;
- d) requestor;
- e) acceptor;
- f) association-initiator;
- g) association-responder;
- h) authentication;
- i) authentication-function;
- j) authentication-value;
- k) authentication-mechanism;
- l) disrupt;
- m) establishment phase; and
- n) data transfer phase.

### 3.6 Association Control protocol specification definitions

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

**3.6.1 Association Control Protocol Machine:** The protocol machine for the Association Control Service Element specified in this Recommendation | International Standard.

**3.6.2 requesting Association Control Protocol Machine:** The Association Control Protocol Machine whose service-user is the requestor of a particular Association Control Service Element service.

**3.6.3 accepting Association Control Protocol Machine:** The Association Control Protocol Machine whose service-user is the acceptor for a particular Association Control Service Element service.

**3.6.4 external event [to an ASE]:** A service primitive that is not directly referenced by an ASE but that may disrupt a service procedure of the ASE.

## 4 Abbreviations

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

### 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 Recommendation | International Standard:

AARE A-ASSOCIATE-RESPONSE APDU  
 AARQ A-ASSOCIATE-REQUEST APDU  
 ABRT A-ABORT APDU  
 ACRP A-ALTER-CONTEXT-RESPONSE APDU  
 ACRC A-ALTER-CONTEXT-REQUEST APDU  
 A-DT A-DATA APDU  
 RLRE A-RELEASE-RESPONSE APDU  
 RLRQ A-RELEASE-REQUEST APDU

### 4.3 Other abbreviations

The following abbreviations are also used in this Recommendation | International Standard:

ACPM Association Control Protocol Machine  
 ACSE Association Control Service Element  
 AE application-entity  
 AEI application-entity invocation  
 Amd. Amendment of an ITU-T Recommendation and of an International Standard  
 AP application-process  
 APCI application-protocol-control-information  
 ASE application-service-element  
 ASN.1 Abstract Syntax Notation One  
 ASO application-service-object  
 ASOI ASO-invocation  
 CF control function  
 cnf confirm primitive  
 ind indication primitive  
 IEC International Electrotechnical Commission  
 ISO International Organization for Standardization  
 ITU-T International Telecommunications Union – Telecommunications Standardization Sector  
 OSI Open Systems Interconnection  
 QoS Quality of Service  
 Rec. Recommendation [ITU-T]  
 req request primitive  
 ROA Recognized Operating Agency

## 5 Conventions

This Recommendation | International Standard employs a tabular presentation of its APDU fields. In clause 7, tables are presented for each ACSE APDU. Each field is summarized using the following notation:

|      |                                      |
|------|--------------------------------------|
| ACPM | Source or sink is the ACPM           |
| cnf  | Sink is related confirm primitive    |
| ind  | Sink is related indication primitive |
| M    | Presence is mandatory                |
| O    | Presence is ACPM option              |
| req  | Source is related request primitive  |
| rsp  | Source is related response primitive |
| U    | Presence is ACSE service-user option |

The structure of each ACSE APDU is specified in clause 9 using the abstract syntax notation of ASN.1 (see ITU-T Rec. X.680 | ISO/IEC 8824-1).

## 6 Overview of the protocol

### 6.1 Service provision

The protocol in this Recommendation | International Standard provides the connection-mode services defined in ITU-T Rec. X.217 *bis* | ISO/IEC 15953. Both the connection-mode and connectionless-mode services are listed in Table 1. The protocol for the connectionless A-UNIT-DATA service is specified in ITU-T Rec. X.237 *bis* | ISO/IEC 15955.

**Table 1 – ACSE services**

| Communication mode | Service         | Type               |
|--------------------|-----------------|--------------------|
| Connection         | A-ASSOCIATE     | Confirmed          |
|                    | A-RELEASE       | Confirmed          |
|                    | A-ABORT         | Non-confirmed      |
|                    | A-P-ABORT       | Provider-initiated |
|                    | A-DATA          | Non-confirmed      |
|                    | A-ALTER-CONTEXT | Confirmed          |
| Connectionless     | A-UNIT-DATA     | Non-confirmed      |

### 6.2 Functional units

Functional units are used by this Recommendation | International Standard to negotiate ACSE user requirements during association establishment. Four functional units are defined:

- Kernel functional unit;
- Authentication functional unit;
- ASO-context negotiation functional unit; and
- Higher Level Association functional unit.

The ACSE requirements fields on the AARQ and AARE APDUs are used to select the functional units for the association. The Kernel functional unit is always available. It is the default functional unit. To be included, the Authentication functional unit, ASO-context negotiation functional unit, and Higher Level Association functional unit shall be explicitly requested on the AARQ APDU and accepted on the AARE APDU.

The selection of the Authentication functional unit supports additional fields on the AARQ, AARE, and RLRQ APDUs. The selection of the ASO-Context negotiation functional unit supports an additional field on the AARQ. Neither functional unit affects the elements of procedure. The optional Higher Level Association functional unit provides for the facility to identify ASO-associations and transparently pass data to child ASOs and allows the ASO-context or the

presentation context on an ASO-association to be modified during the lifetime of the association. Note that some higher level associations may have a scope that precludes the use of Session Functional Units other than Kernel and Full Duplex.

For details on the use of Higher Level Association functional units, see Annexes C, D, and E. Table 2 shows the services, APDUs and APDU fields associated with the ACSE functional units.

**Table 2 – Functional Unit APDUs and their fields**

| Functional Unit | Service     | APDU | Field Name                          |
|-----------------|-------------|------|-------------------------------------|
| Kernel          | A-ASSOCIATE | AARQ | Protocol Version                    |
|                 |             |      | ASO-context-name                    |
|                 |             |      | Calling AP-title                    |
|                 |             |      | Calling AE-qualifier                |
|                 |             |      | Calling AP-invocation-identifier    |
|                 |             |      | Calling AE-invocation-identifier    |
|                 |             |      | Called AP-title                     |
|                 |             |      | Called AE-qualifier                 |
|                 |             |      | Called AP-invocation-identifier     |
|                 |             |      | Called AE-invocation-identifier     |
|                 |             |      | Implementation Information          |
|                 |             |      | User-information                    |
|                 |             |      | Called ASOI-Tag                     |
|                 |             |      | Calling ASOI-Tag                    |
|                 |             |      | Presentation contex definition list |
|                 |             | AARE | Protocol Version                    |
|                 |             |      | ASO-context-name                    |
|                 |             |      | Responding AP-title                 |
|                 |             |      | Responding AE-qualifier             |
|                 |             |      | Responding AP-invocation-identifier |
|                 |             |      | Responding AE-invocation-identifier |
|                 |             |      | Result                              |
|                 |             |      | Result source – Diagnostic          |
|                 |             |      | Implementation Information          |
|                 |             |      | User-information                    |
|                 |             |      | Responding ASOI-Tag                 |
|                 |             |      | Presentation context result list    |
|                 | A-RELEASE   | RLRQ | Reason                              |
|                 |             |      | ASO-qualifier                       |
|                 |             |      | ASOI-identifier                     |
|                 |             |      | User-information                    |
|                 |             | RLRE | Reason                              |
|                 |             |      | ASO-qualifier                       |
|                 |             |      | ASOI-identifier                     |
|                 |             |      | User-information                    |
|                 |             |      |                                     |
|                 |             |      |                                     |
|                 |             |      |                                     |
|                 |             |      |                                     |

Table 2 (concluded)

| Functional Unit          | Service         | APDU | Field Name                                                                 |
|--------------------------|-----------------|------|----------------------------------------------------------------------------|
| Authentication           | A-ASSOCIATE     | ABRT | Reason<br>ASO-qualifier<br>ASOI-identifier<br>User-information             |
|                          |                 | AARQ | ACSE requirements<br>Authentication-mechanism Name<br>Authentication-value |
|                          |                 | AARE | ACSE requirements<br>Authentication-mechanism Name<br>Authentication-value |
| ASO-context-negotiation  | A-ABORT         | ABRT | Diagnostic                                                                 |
|                          | A-ASSOCIATE     | AARQ | ASO-context-name-list<br>ACSE requirements                                 |
|                          | A-ASSOCIATE     | AARE | ASO-context-name-list<br>ACSE requirements                                 |
| Higher Level Association | A-DATA          | A-DT | ASO-qualifier<br>ASOI-identifier<br>User data                              |
|                          | A-ALTER-CONTEXT | ACRQ | ASO-qualifier<br>ASOI-identifier<br>ASO-context<br>P-context<br>User data  |
|                          |                 | ACRP | ASO-qualifier<br>ASOI-identifier<br>ASO-context<br>P-context<br>User data  |

### 6.3 Use of supporting services

There are two distinct cases that must be considered in mapping ACSE to a supporting service:

- 1) ACSE may use a Presentation Connection as a supporting service; or
- 2) ACSE may use an ASO-association that is not an application-association, i.e. an ASO-association is being established over another ASO-association (which may be an application association) or any equivalent supporting service.

ACSE defines a service definition for a generic supporting service (called the IA-service, see clause 8) to define its mapping to a supporting service<sup>2)</sup>. Annexes to this Recommendation | International Standard specify mappings of this IA-service to specific supporting services, e.g. the Presentation service and the ACSE service. Other standards may define other mappings as required.

In the connectionless mode, the A-UNIT-DATA APDU may be mapped to either a connection-mode or connectionless-mode supporting service. If the higher-level functional unit is selected, all connection-mode ACSE APDUs can be mapped to the A-UNIT-DATA service primitives.

## 6.4 Model

The Association Control Protocol Machine (ACPM) is modeled as a finite state machine whose specification is given in this Recommendation | International Standard. The ACPM communicates with its service-user by means of the ACSE service primitives defined in ITU-T Rec. X.217 *bis* | ISO/IEC 15953. The ACPM communicates with its supporting service-provider by means of either the ACSE service or Presentation services defined in ITU-T Rec. X.216 | ISO/IEC 8822.

NOTE 1 – An application ASE or ASO specification that references ACSE need not specify the use of ACSE service primitive parameters that are irrelevant to its operation. The control function (CF) that references ACSE can be modeled to pass such parameters between the ACPM and that part of the ASOI to which the parameters are relevant.

The ACPM is driven by the receipt of input events from its ACSE service-user and from its service-provider that supports the association. The input events from the ACSE service-user are ACSE request and response primitives.

The ACPM responds to input events by issuing output events to its service-provider and to its ACSE service-user. The output events to its ACSE service-user are ACSE indication and confirm primitives.

The receipt of an input event, the generation of dependent actions, and the resultant output event are considered to be an indivisible action.

During the establishment of an association among ASOs, the existence of invocations of the requesting and responding ASOs is presumed. How they are created is outside of the scope of this Recommendation | International Standard.

A new invocation of an ACPM is employed upon the receipt of an A-ASSOCIATE request/indication primitive or a IA-BIND-REQUEST.deliver primitive. Each such invocation controls exactly one association.

NOTE 2 – Each association may be identified in an end system by a local mechanism so that the ACSE service-user and the ACPM can refer to the association.

When the ACPM is a component of the outermost ASO, an ACPM communicates with its peer ACPM in support of an association by transferring ACSE Application Protocol Data Units (APDUs) defined in clause 9. An ACSE APDU is transferred as the User data parameter of an A-DATA primitive or a value in the User data parameter of a service primitive of the supporting service.

## 6.5 User summary mechanism

If the fast associate mechanism is used during association establishment, the initiating ACPM as well as forming an AARQ APDU to be passed to the Presentation service-provider in the User data parameter of a P-CONNECT request, also passes the semantic content of the AARQ in the User summary parameter of the P-CONNECT request. The User summary parameter references an Upper-Layer Context specification and is a purely abstract parameter. If the A-ASSOCIATE request User-information parameter was present, the semantic content of this will have been supplied to the ACPM in the User summary parameter of the A-ASSOCIATE request, and is conceptually included in the User summary parameter of the P-CONNECT request.

If the Presentation provider (via the Session service and protocol) makes use of the fast associate mechanism, the responding ACPM will receive only the User summary parameter on the P-CONNECT indication, and not the User data. The responding implementation will reconstruct the semantic content of the AARQ that would have been present in the P-CONNECT User data, and issue an A-ASSOCIATE indication with a User summary parameter in place of its User data.

<sup>2)</sup> It is recommended that ASO designers provide this kind of supporting service definition for their ASO and define the mapping to a specific supporting service definition separately (rather than specifying a mapping to an existing service definition). This approach emphasizes that the ASO can be used with any supporting service that provides an equivalent service. This facilitates the re-use of the ASO and makes it easier for subsequent designers to utilize this ASO with alternate supporting services. Of course, if the designer's intent is that the ASO can only be supported by a specific supporting service, then it should reference that service definition.

Similarly, the responding ACPM will form a User summary parameter on the P-CONNECT response from the AARE APDU, including the semantic content of the User summary parameter of the A-ASSOCIATE response (if present) by reference to the same Upper-Layer Context specification. The initiating ACPM reconstructs the AARE.

NOTE – The passing of the User summary parameters and reconstruction of the ACSE APDUs from the Presentation User summary parameters is abstract. There is no requirement for a real implementation to perform these actions.

## 7 Elements of procedure

The ACSE protocol consists of the following procedures:

- a) association establishment;
- b) normal release of an association;
- c) abnormal release of an association;
- d) A-DATA; and
- e) ALTER CONTEXT.

In this clause, a summary of each of these elements of procedure is presented. This consists of a summary of the relevant APDUs, and a high-level overview of the relationship between the ACSE services, the APDUs involved, and the mapping to the IA-service. Clause 8 describes the IA-service definition, which defines the abstract service that ACSE requires of any supporting service. In clause 9, a detailed specification of the ACSE APDUs is given using the notation of ASN.1 (see ITU-T Rec. X.680 | ISO/IEC 8824-1). Annex A presents the state table for the ACPM. Annex B specifies a simple password authentication-mechanism. Annex C provides the specific mapping of the IA-service to the Presentation service. Annex D provides the specific mapping of the IA-service to the ACSE Service. Annex E provides guidance on the use of the Higher Level Association functional units.

### 7.1 Association establishment

#### 7.1.1 Purpose

The association establishment procedure is used to establish an association among ASOs. It supports the A-ASSOCIATE service.

#### 7.1.2 APDUs used

The association establishment procedure uses the A-ASSOCIATE-REQUEST (AARQ) and the A-ASSOCIATE-RESPONSE (AARE) APDUs. The fields of the AARQ APDU are listed in Table 3. The fields of the AARE APDU are listed in Table 4.

#### 7.1.3 Association establishment procedure

This procedure is driven by the following events:

- a) invocation of an A-ASSOCIATE request primitive from the requestor;
- b) receipt of an AARQ APDU;
- c) receipt of a User summary parameter on a P-CONNECT indication primitive;
- d) invocation of an A-ASSOCIATE response primitive from the acceptor; and
- e) receipt of an AARE APDU or a User summary parameter.

##### 7.1.3.1 A-ASSOCIATE request primitive

The requesting ACPM forms an AARQ APDU from parameter values of the A-ASSOCIATE request primitive and the protocol version and optionally implementation information. The AARQ PDU is mapped to the User-information parameter of the IA-BIND-REQUEST.submit primitive. The ACPM transitions to the Awaiting AARE (STA1) state.

If the fast-associate mechanism is supported, the requesting ACPM identifies the semantic content of the AARQ, including the User data, in the User summary parameter of the P-CONNECT request.

### 7.1.3.2 AARQ APDU

The accepting ACPM receives an AARQ APDU as the User-information parameter of an IA-BIND-REQUEST.deliver primitive or reconstructs an AARQ APDU from the User summary parameter of the P-CONNECT indication primitive.

The ACPM determines if the AARQ APDU is acceptable based on the rules for extensibility (see 7.6). If the AARQ APDU is not acceptable, a protocol error results (see 7.3.3.4). The association establishment procedure is disrupted. An A-ASSOCIATE indication primitive is not issued. An AARE APDU is formed indicating the error. This APDU is mapped to the User-information parameter of an IA-BIND-RESPONSE.submit primitive, which is invoked. The ACPM transitions to the Idle-Unassociated (STA0) state.

Otherwise, the ACPM next inspects the value of the Protocol Version field of the AARQ APDU. If the ACPM does not support a common protocol version, it forms an AARE APDU with the following assigned fields:

- Protocol Version field (optional) with the value that indicates the protocol version(s) that it could support (see 7.1.5.1);
- ASO-context-name field with the same value as on the AARQ APDU;
- Result field with the value "rejected (permanent);" and source – Diagnostic field with the values "ACSE service-provider" and "no common ACSE version."

In this case, the ACPM sends the AARE APDU. The ACPM does not issue an A-ASSOCIATE indication primitive. The AARE is mapped to the User-information parameter of the IA-BIND-RESPONSE.submit primitive and it is invoked. The association is not established and the ACPM is in the Idle-Unassociated (STA0) state.

If the AARQ APDU is acceptable, the ACPM performs the following actions.

If the ACSE requirements field is present, it forms an ACSE requirements field for the AARE APDU that is the intersection of the functional units requested in the AARQ and those that it supports.

If the ASO-context field or Presentation context definition list are present, it forms the proper result parameters for the AARE.

The ACPM then issues an A-ASSOCIATE indication primitive to the acceptor, and transitions to the Awaiting A-ASCrsp (STA2) state.

### 7.1.3.3 A-ASSOCIATE response primitive

When the accepting ACPM receives the A-ASSOCIATE response primitive, the Result parameter specifies whether the service-user has accepted or rejected the association. The ACPM forms an AARE APDU using the A-ASSOCIATE response primitive parameters and parameters received in the AARQ. The ACPM sets the Result source – Diagnostic field to "ACSE service-user" and the value derived from the Diagnostic parameter of the response primitive. The AARE APDU is mapped to the User-information parameter of an IA-BIND-RESPONSE.submit primitive.

**Table 3 – AARQ APDU parameters**

| Field name                       | Presence | Source | Sink |
|----------------------------------|----------|--------|------|
| Protocol Version                 | M        | ACPM   | ACPM |
| ASO-context-name                 | U        | req    | ind  |
| ASO-context-name-list            | U        | req    | ind  |
| Calling AP-Title                 | U        | req    | ind  |
| Calling AE qualifier             | U        | req    | ind  |
| Calling AP-invocation-identifier | U        | req    | ind  |
| Calling AE-invocation-identifier | U        | req    | ind  |
| Called AP-title                  | U        | req    | ind  |
| Called AE-qualifier              | U        | req    | ind  |
| Called AP-invocation-identifier  | U        | req    | ind  |
| Called AE-invocation-identifier  | U        | req    | ind  |
| ACSE requirements                | U        | req    | ind  |
| Authentication-mechanism Name    | U        | req    | ind  |

**Table 3 (concluded)**

| Field name                                                                                                                                                                                                                                                                                                                  | Presence | Source | Sink |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|------|
| Authentication-value                                                                                                                                                                                                                                                                                                        | U        | req    | ind  |
| Implementation Information                                                                                                                                                                                                                                                                                                  | O        | ACPM   | ACPM |
| User-information                                                                                                                                                                                                                                                                                                            | U        | req    | ind  |
| Called ASOI-tag                                                                                                                                                                                                                                                                                                             | U        | req    | ind  |
| Calling ASOI-tag                                                                                                                                                                                                                                                                                                            | U        | req    | ind  |
| Presentation context definition list                                                                                                                                                                                                                                                                                        | C        | req    | ind  |
| NOTE 1 – The Authentication-mechanism Name and Authentication-value fields are only present if the ACSE requirements field includes the Authentication functional unit.                                                                                                                                                     |          |        |      |
| NOTE 2 – The ASO-context-name-List field is only present if the ACSE requirements field includes the ASO-context negotiation functional unit. The value of the ASO-context-name parameter may be different from any of the names in the ASO-context-name-list parameter or it may be equal to one of the names in the list. |          |        |      |

If the fast-associate mechanism is supported, the accepting ACPM identifies the semantic content of the AARE, including the User data, in the User summary parameter of the P-CONNECT response, by reference to the Upper-Layer Context specification identified by the User summary parameter of the received P-CONNECT indication.

If the acceptor accepted the association request, the Result field of the outgoing AARE APDU specifies "accepted". The association is established and the ACPM transitions to the Associated (STA5) state.

If the acceptor rejected the association request, the Result field of the AARE APDU contains the appropriate rejection value. The association is not established and the ACPM issues an IA-UNBIND.request primitive and transitions to the Idle-Unassociated (STA0) state.

#### 7.1.3.4 AARE APDU

The requesting ACPM receives an AARE APDU as the User-information parameter of an IA-BIND-RESPONSE.deliver primitive. The following situations are possible:

- the association has been accepted;
- the accepting ACPM or the acceptor has rejected the association; or
- the supporting service-provider has rejected the request for the underlying service.

**Table 4 – AARE APDU Fields**

| Field name                          | Presence | Source   | Sink |
|-------------------------------------|----------|----------|------|
| Protocol Version                    | O        | ACPM     | ACPM |
| ASO-context-name                    | U        | rsp      | cnf  |
| ASO-context-name-list               | U        | req      | ind  |
| Responding AP-title                 | U        | rsp      | cnf  |
| Responding AE-qualifier             | U        | rsp      | cnf  |
| Responding AP-invocation-identifier | U        | rsp      | cnf  |
| Responding AE-invocation-identifier | U        | rsp/ACPM | cnf  |
| Result                              | O        | rsp/ACPM | cnf  |
| Result source – Diagnostic          | O        | rsp      | cnf  |
| ACSE Requirements                   | U        | req      | ind  |
| Authentication-mechanism Name       | U        | req      | ind  |
| Authentication-value                | U        | req      | ind  |

Table 4 (concluded)

| Field name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Presence | Source | Sink |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|------|
| Implementation Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | O        | ACPM   | ACPM |
| User-information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | U        | rsp    | cnf  |
| Responding ASOI-tag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | U        | req    | ind  |
| Presentation context result identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | C        | rsp    | cnf  |
| <p>NOTE 1 – The authentication-mechanism and authentication-value fields are only present if the ACSE requirements field includes the Authentication functional unit.</p> <p>NOTE 2 – The ASO-context-name-list field is only present if the ACSE requirements field includes the ASO-context negotiation functional unit and the result = rejected. The value of the ASO-context-name parameter may be different from any of the names in the ASO-context-name-list parameter or it may be equal to one of the names in the list.</p> <p>NOTE 3 – This ASO-context field is optional. If backward compatibility with older implementations of ACSE is desired, it must be present.</p> |          |        |      |

If the association was accepted, the Result field of the AARE APDU specifies "accepted". If it exists, the User summary parameter is a value from which the requesting ACPM can reconstruct the AARE APDU. The requesting ACPM issues an A-ASSOCIATE confirm primitive to the requestor derived from parameters from the supporting service and the AARE APDU. The A-ASSOCIATE confirm primitive Result parameter specifies "accepted". The association is established and the ACPM transitions to the Associated (STA5) state.

If the association was rejected by either the accepting ACPM or by the acceptor, the AARE APDU result parameter specifies "user-rejection". The requesting ACPM issues an A-ASSOCIATE confirm primitive to the requestor derived from parameters from the supporting service and the AARE APDU. The A-ASSOCIATE confirm primitive Result parameter indicates "rejected (transient)" or "rejected (permanent)". The Result source parameter indicates "ACSE service-user" or "ACSE service-provider". The association is not established, and the ACPM issues an IA-UNBIND-REQUEST.submit primitive and transitions to the Idle-Unassociated (STA0) state.

If the request was rejected by the supporting service-provider, the underlying confirm primitive Result parameter specifies "provider-rejection". The requesting ACPM issues an A-ASSOCIATE confirm primitive with the Result parameter indicating "rejected (permanent)". The Result source parameter indicates "supporting service-provider". The association is not established, and the ACPM issues an IA-UNBIND request primitive and transitions to the Idle-Unassociated (STA0) state.

#### 7.1.4 Use of the AARQ APDU fields

The AARQ APDU fields are used by the requesting and accepting ACPMs as specified below.

##### 7.1.4.1 Protocol Version

For the requesting ACPM: the value assigned to this field is determined within the implementation of the ACPM. It is a bit string where each bit that is set to one indicates the version of ACSE protocol that this ACPM supports. Bit 0 represents version 1; bit 1 represents version 2, etc. Multiple bits may be set indicating support of multiple versions. No trailing bits higher than the highest version of this Recommendation | International Standard that the requesting ACPM supports are included. That is, the last bit of the string is set to one.

For the accepting ACPM: the ACPM ignores trailing bits of this field that are higher than the one indicating the latest version of this Recommendation | International Standard that it supports.

##### 7.1.4.2 ASO-context-name

For the requesting ACPM: this value is determined by the value of the ASO-context-name parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: this value is used to determine the value of the ASO-context-name parameter of the A-ASSOCIATE indication primitive, if issued.

NOTE – This field is optional. If backward compatibility with older implementations of ACSE is desired, it must be present.

### 7.1.4.3 ASO-context-name-list

For the requesting ACPM: the values assigned to this field are determined by the values of the ASO-context-name-list parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: the values are used to determine the values of the ASO-context-name-list parameter on the A-ASSOCIATE indication primitive, if issued.

### 7.1.4.4 Calling AP-title

For the requesting ACPM: this value is determined by the value of the Calling AP-title parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: this value is used to determine the value of the Calling AP-title parameter of the A-ASSOCIATE indication primitive, if issued.

### 7.1.4.5 Calling AE-qualifier

#### 7.1.4.5.1 For the requesting ACPM

If the A-ASSOCIATE request is not for a nested association, but the Calling ASOI-tag parameter of the A-ASSOCIATE request contains precisely one (ASO-qualifier, ASOI-identifier) element, the value of the Calling AE-qualifier field is determined by the value of the ASOI-identifier in that element. Otherwise the field shall be absent.

If the A-ASSOCIATE request is for a nested association (i.e. the A-ASSOCIATE request was issued in the context of an established, nesting association), the value of the Calling AE-qualifier shall be determined by the value of the ASOI-identifier in the last element of the Calling ASOI-tag parameter of the A-ASSOCIATE request.

NOTE – The other elements of the ASOI-tag will be implicit in the nesting association.

#### 7.1.4.5.2 For the accepting ACPM

If the AARQ is not for a nested association, the value of the Calling AE-qualifier field shall determine the value of the ASOI-identifier in the first and only element of the Calling ASOI-tag parameter of the A-ASSOCIATE indication.

If the received AARQ is for a nested association (i.e. it is received in the context of an established association), the accepting ACPM shall create a value for the Calling ASOI-tag parameter of the A-ASSOCIATE indication from the value of the ASOI-tag for the peer side as sent or received during the establishment of the nesting association, with one additional (ASO-qualifier, ASOI-identifier) element. The value of the Calling AE-qualifier field of the received AARQ shall determine the value of the ASOI-identifier in the new, last element of the Calling ASOI-tag parameter of the A-ASSOCIATE indication.

If the nesting and nested associations are established in same directions, the ASOI-tag for the peer side is the Calling ASOI-tag on the A-ASSOCIATE request that established the nesting association. If the nesting and nested associations are established from the same direction, the ASOI-tag for the peer side will be the Responding ASOI-tag (if present) on the A-ASSOCIATE confirm that established the nesting association, or the Called ASOI-tag on the A-ASSOCIATE indication that established the nesting association, if the Responding ASOI-tag was not present on the A-ASSOCIATE confirm.

### 7.1.4.6 Calling AP-invocation-identifier

For the requesting ACPM: this value is determined by the value of the Calling AP-invocation-identifier parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: this value is used to derive the value of the Calling AP-invocation-identifier parameter of the A-ASSOCIATE indication primitive, if issued.

### 7.1.4.7 Calling AE-invocation-identifier

For the requesting ACPM: this value is determined by the value of the Calling AE-invocation-identifier parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: this value is used to derive the value of the Calling AE-invocation-identifier parameter of the A-ASSOCIATE indication primitive, if issued.

#### 7.1.4.8 Called AP-title

For the requesting ACPM: this value is determined by the value of the Called AP-title parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: this value is used to determine the value of the Called AP-title parameter of the A-ASSOCIATE indication primitive, if issued.

#### 7.1.4.9 Called AE-qualifier

##### 7.1.4.9.1 For the requesting ACPM

If the A-ASSOCIATE request is not for a nested association, but the Called ASOI-tag parameter of the A-ASSOCIATE request contains precisely one (ASO-qualifier, ASOI-identifier) element, the value of the Called AE-qualifier field is determined by the value of the ASO-qualifier in that element. Otherwise the field shall be absent.

If the A-ASSOCIATE request is for a nested association (i.e. the A-ASSOCIATE request was issued in the context of an established, nesting association), the value of the Called AE-qualifier shall be determined by the value of the ASO-qualifier in the last element of the Called ASOI-tag parameter of the A-ASSOCIATE request.

NOTE – The other elements of the ASOI-tag will be implicit in the nesting association.

##### 7.1.4.9.2 For the accepting ACPM

If the AARQ is not for a nested association, the value of the Called AE-qualifier field shall determine the value of the ASO-qualifier in the first and only element of the Called ASOI-tag parameter of the A-ASSOCIATE indication.

If the received AARQ is for a nested association (i.e. it is received in the context of an established association), the accepting ACPM shall create a value for the Called ASOI-tag parameter of the A-ASSOCIATE indication from the value of the ASOI-tag for this side as sent or received during the establishment of the nesting association, with one additional (ASO-qualifier, ASOI-identifier) element. The value of the Called AE-qualifier field of the received AARQ shall determine the value of the ASO-qualifier in the new, last element of the Called ASOI-tag parameter of the A-ASSOCIATE indication.

If the nesting and nested associations are established from the same direction, the ASOI-tag for this side will be the Responding ASOI-tag (if present) on the A-ASSOCIATE confirm that established the nesting association, or the Called ASOI-tag on the A-ASSOCIATE indication that established the nesting association, if the Responding ASOI-tag was not present on the A-ASSOCIATE confirm. If the nesting and nested associations are established in different directions, the ASOI-tag for this side is the Calling ASOI-tag on the A-ASSOCIATE request that established the nesting association.

#### 7.1.4.10 Called AP-invocation-identifier

For the requesting ACPM: this value is determined by the value of the Called AP-invocation-identifier parameter of the A-ASSOCIATE request primitive.

For the accepting ACPM: this value is used to derive the value of the Called AP-invocation-identifier parameter of the A-ASSOCIATE indication primitive, if issued.

#### 7.1.4.11 Called AE-invocation-identifier

##### 7.1.4.11.1 For the requesting ACPM

If the A-ASSOCIATE request is not for a nested association, but the Called ASOI-tag parameter of the A-ASSOCIATE request contains precisely one (ASO-qualifier, ASOI-identifier) element, the value of the Called AE-qualifier field is determined by the value of the ASOI-identifier in that element. Otherwise the field shall be absent.

If the A-ASSOCIATE request is for a nested association (i.e. the A-ASSOCIATE request was issued in the context of an established, nesting association), the value of the Called AE-qualifier shall be determined by the value of the ASOI-identifier in the last element of the Called ASOI-tag parameter of the A-ASSOCIATE request.

NOTE – The other elements of the ASOI-tag will be implicit in the nesting association.

##### 7.1.4.11.2 For the accepting ACPM

If the AARQ is not for a nested association, the value of the Called AE-qualifier field shall determine the value of the ASOI-identifier in the first and only element of the Called ASOI-tag parameter of the A-ASSOCIATE indication.

If the received AARQ is for a nested association (i.e. it is received in the context of an established association), the accepting ACPM shall create a value for the Called ASOI-tag parameter of the A-ASSOCIATE indication from the value of the ASOI-tag for this side as sent or received during the establishment of the nesting association, with one additional (ASO-qualifier, ASOI-identifier) element. The value of the Called AE-qualifier field of the received AARQ shall determine the value of the ASOI-identifier in the new, last element of the Called ASOI-tag parameter of the A-ASSOCIATE indication.