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Information technology — Remote Operations: OSI realizations — Remote Operations Service Element (ROSE) service definition

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Technologies de l'information — Opérations à distance: Réalisations OSI — Définition du service pour l'élément de service des opérations à distance (ROSE)

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Foreword

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

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

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International Standard ISO/IEC 13712-2 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.881.

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This part of ISO/IEC 13712 is a partial revision of ISO/IEC 9072-1:1989.

ISO/IEC 13712 consists of the following parts, under the general title *Information technology — Remote operations*:

— *Part 1: Concepts, model and notation*

— *Part 2: OSI realizations — Remote Operations Service Element (ROSE) service definition*

— *Part 3: OSI realizations — Remote Operations Service Element (ROSE) protocol specification*

Annex A forms an integral part of this part of ISO/IEC 13712. Annexes B and C are for information only.

Introduction

Remote operations (ROS) is a paradigm for interactive communication between objects. As such it can be used in the design and specification of distributed applications. The basic interaction involved is the invocation of an operation by one object (the invoker), its performance by another (the performer), possibly followed by a report of the outcome of the operation being returned to the invoker.

The concepts of ROS, as specified in ITU-T Rec. X.880 | ISO/IEC 13712-1, are abstract and may be realized in many ways. For example, objects whose interactions employ ROS concepts may be separated by a software interface or by an OSI network.

This Recommendation | International Standard provides the framework for the realization of an operation package and association contract as an OSI application context. Such an application context is specified primarily in terms of a collection of application service elements (ASE). From a ROS perspective, these ASEs fall into three broad categories:

a) operation-specific ASEs, which embody knowledge of the definitions of the operations in the association contract;

b) the Remote Operations ASE (ROSE) which drives the general-purpose protocol required to invoke and report returns of arbitrary operations;

c) information transfer ASEs concerned with the establishment and release of associations where necessary, and the communication of the ROSE protocol control information (PCI). In the OSI realization, such ASEs are the Association Control Service Element (ACSE), the Reliable Transfer Service Element (RTSE) used together with the services of the Presentation layer.

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This Recommendation | International Standard focuses on the derivation of ROSE-based application context specifications, the service provided by ROSE, and the way that ROSE is used. This Recommendation | International Standard is a revision of CCITT Rec. X.219 | ISO/IEC 9072-1. The existing usage of ROSE in connection with ACSE, RTSE and the Presentation layer as defined in CCITT Rec. X.219 | ISO/IEC 9072-1 remains valid after this revision. This revision makes no change to the ROSE PCI.

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ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – REMOTE OPERATIONS: OSI REALIZATIONS – REMOTE OPERATIONS SERVICE ELEMENT (ROSE) SERVICE DEFINITION

1 Scope

This Recommendation | International Standard provides the framework for the realization as an OSI application context of the abstracts concepts of operation package and association contract defined in ITU-T Rec. X.880 | ISO/IEC 13712-1. Such an application context is described in terms of a collection of application service elements, in particular the Remote Operations Application Service Element (ROSE), which drives the general purpose protocol for invoking and reporting the returns of arbitrary operations.

The terms, definitions, and mechanisms defined in ITU-T Rec. X.880 | ISO/IEC 13712-1 apply here and are specialized for an OSI realization as specified in this Recommendation | International Standard. This Recommendation | International Standard focuses on the services provided by ROSE, and the way ROSE is used. The ROSE services are provided by the use of the ROSE protocol (specified in a companion Recommendation | International Standard, ITU-T Rec. X.882 | ISO/IEC 13712-3), in conjunction with the Association Control Service Element (ACSE) services (ITU-T Rec. X.217 | ISO 8649) and the ACSE protocol (ITU-T Rec. X.227 | ISO 8650), and, optionally, the Reliable Transfer Service Element (RTSE) services (ITU-T Rec. X.218 | ISO/IEC 9066-1) and the RTSE protocol (ITU-T Rec. X. 228 | ISO/IEC 9066-2), and the Presentation service (ITU-T Rec. X.216 | ISO/IEC 8822).

No requirement is made for conformance to this Recommendation | International Standard.

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2 Normative references

The following ITU-T Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Specification. 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 Specification are encouraged to investigate the possibility of applying the most recent editions of the Recommendations and Standards indicated 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.

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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.210 (1993) | ISO/IEC 10731:1994, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definitions of OSI services.*
- ITU-T Recommendation X.215 (1994) | ISO 8326:—[1], *Information processing systems — Open Systems Interconnection — Basic connection oriented session service definition.*
- ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology — Open Systems Interconnection — Presentation service definition.*
- ITU-T Recommendation X.217 (1995) | ISO 8649:—[2], *Information processing systems — Open Systems Interconnection — Service definition for the Association Control Service Element.*
- ITU-T Recommendation X.227 (1995) | ISO 8650:—[3], *Information processing systems — Open Systems Interconnection — Protocol specification for the Association Control Service Element.*
- ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

1) To be published. (Revision of ISO 8326:1987)

2) To be published. (Revision of ISO 8649:1988)

3) To be published. (Revision of ISO 8650:1988)

- 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.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.880 (1994) | ISO/IEC 13712-1:1995, *Information technology – Remote Operations: Concepts, model and notation.*
- ITU-T Recommendation X.882 (1994) | ISO/IEC 13712-3:1995, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) protocol specification.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- ITU-T Recommendation X.218 (1993), *Reliable Transfer: Model and service definition.*

  ISO/IEC 9066-1:1989, *Information processing systems – Text communication – Reliable Transfer – Part 1: Model and service definition.*
- ITU-T Recommendation X.228 (1993), *Reliable Transfer – Protocol specification.*

  ISO/IEC 9066-2:1989, *Information processing systems — Text communication — Reliable Transfer — Part 2: Protocol specification.*
- CCITT Recommendation X.219 (1988), *Remote Operations: Model, notation and service definition.*

  ISO/IEC 9072-1:1989, *Information processing systems – Text communication – Remote Operations – Part 1: Model, notation and service definition.*
- CCITT Recommendation X.229 (1988), *Remote Operations: Protocol specification.*

  ISO/IEC 9072-2:1989, *Information processing systems – Text communication – Remote Operations – Part 2: Protocol specification.*

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3 Definitions

3.1 Reference Model definitions

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

a) abstract syntax;

b) Application Layer;

c) application-process;

d) application-entity;

e) application-service-element;

f) application-protocol-data-unit;

g) application-protocol-control-information;

h) Presentation Layer;

i) presentation-service.

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) service-primitive; primitive;

g) request (primitive);

h) indication (primitive);

i) response (primitive); and

j) confirm (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 name;

b) transfer syntax name;

c) presentation context.

3.4 Association control definitions

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

a) application-association; association;

b) application context;

c) Association Control Service Element.

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3.5 Reliable Transfer definitions

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This Recommendation | International Standard makes use of the following terms defined in CCITT Recommendation X.218 | ISO/IEC 9066:

– Reliable Transfer Service Element.

3.6 ROSE definitions

For the purpose of this Recommendation | International Standard the following definitions apply:

3.6.1 association-initiating-application-entity; association-initiator: The application-entity that initiates the application-association.

3.6.2 association-responding-application-entity; association-responder: The application-entity that responds to the initiation of an application-association by another AE.

3.6.3 invoking-application-entity; invoker: The application-entity that invokes the Remote Operation.

3.6.4 performing-application-entity; performer: The application-entity that performs a Remote Operation invoked by the other application-entity.

3.6.5 requestor: The part of an application-entity that issues a request primitive for a particular ROSE service.

3.6.6 acceptor: The part of an application-entity that receives the indication primitive for a particular ROSE service.

3.6.7 linked operation: See 3.3.8 of ITU-T Rec. X.880 | ISO/IEC 13712-1.

3.6.8 parent-operation: An operation during whose execution the performer may invoke linked-operations.

3.6.9 child-operation: An operation that is invoked by the performer of a parent-operation in response to the latter operation's invocation.

3.6.10 ACSE-user: That portion of an application entity which performs the mapping of the bind operation and unbind operation onto ACSE.

3.6.11 Remote Operation Service Element: The application-service-element defined in this Recommendation | International Standard.

3.6.12 ROSE-provider: The provider of the Remote Operations Service Element services.

3.6.13 ROSE-user: That portion of an application entity which interacts with ROSE for the purpose of communicating with the remotely-located peer user.

3.6.14 RTSE-user: That portion of an application entity which performs the mapping of the bind operation and unbind operation onto RTSE.

4 Abbreviations

AE	Application entity
ACSE	Association Control Service Element
ASE	Application service element
ASN.1	Abstract Syntax Notation One
APDU	Application protocol data unit
RO (or ROS)	Remote Operations
ROSE	Remote Operations Service Element
RT (or RTS)	Reliable Transfer
RTSE	Reliable Transfer Service Element

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5 Conventions

This Recommendation | International Standard defines services for the ROSE following the descriptive conventions defined in ITU-T Rec. X.210 | ISO/IEC 10731. In clause 8, the definition of each ROSE service includes a table that lists the parameters of its primitives. For a given primitive, the presence of each parameter is described by one of the following values:

Blank	Not applicable
M	Mandatory
U	User option
C	Conditional
O	Presence is a ROSE service-provider option

In addition, the notation (=) indicates that a parameter value is semantically equal to the value to its left in the table.

This specification employs ASN.1, as specified in ITU-T Rec. X.681 | ISO/IEC 8824-2, to define the **APPLICATION-CONTEXT** information object class. This also provides the notation with which designers of ROS applications can specify particular instances of the class.

6 OSI Realization model for ROS

A general model for the realization of ROS by communication means is shown in Figure 1 (reproduced from Figure 3 of ITU-T Rec. X.880 | ISO/IEC 13712-1).

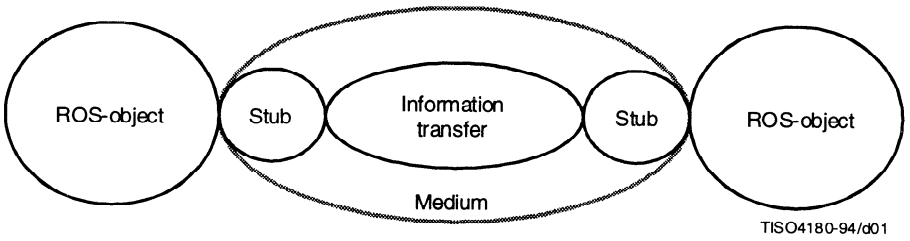

Figure 1 – Communications realization of ROS

Here the stubs represent the ability for the ROS-objects to invoke operations remotely. A particular stub corresponds to the operations in some association contract. The information transfer object conveys protocol data units (PDUs) between the stubs.

This document is concerned with the ROS-objects being realized as application-processes, and the medium by the communications services of OSI.

Figure 2 is a rearranged and expanded version of Figure 1, overlaying on it some of the principal concepts of the application layer of OSI.

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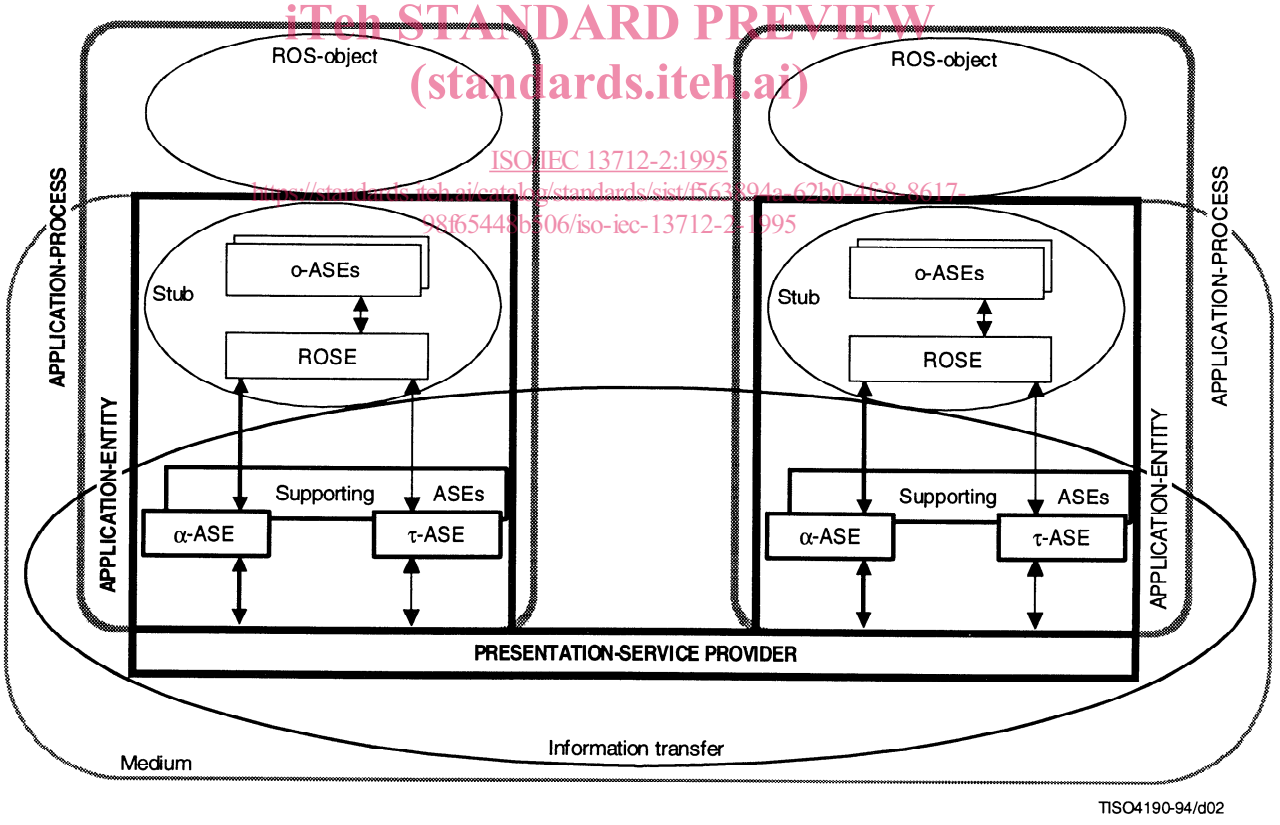

α-ASE ASE providing (dynamic) association establishment and release
τ-ASE ASE providing information transfer
ROSE Remote Operations ASE
o-ASEs operation-specific ASEs

Figure 2 – OSI realization of ROS

The stub objects are realized by ROSE together with a collection of operation-specific ASEs. ROSE, whose services are defined in clause 8, drives the generic protocol required to invoke and report returns of arbitrary operations. Each operation-specific ASE embodies knowledge of the definitions of the specific operations involved in some operation package. Where the operation package is asymmetrical, the corresponding operation-specific ASE is also asymmetrical, having a consumer or supplier role to match that of the ROS-object which it is representing. Collectively, ROSE and the operation-specific ASEs have knowledge of all of the operations of the association contract.

The information transfer object is realized by the OSI presentation-service provider, together with a collection of ASEs which shall include an α-ASE, may include a τ-ASE, and may also include ASEs supporting these (e.g. an ASE providing a Directory User Agent function). The collection always include ACSE. Different OSI realizations of ROS result from the use of different collections of these ASEs.

The use of the ROSE services is only possible after a transfer service has been made available on the application association. This transfer service can be available either directly at the level of the Presentation service, or as a service provided by an ASE (see the τ-ASE in Figure 2).

7 ROS-based application contexts

7.1 General

The particular set of ASEs involved in realizing some particular association contract, together with any rules for their coordinated working, constitutes an application context. The application context include all ASEs contributing to the stubs and to the information transfer object.

In realizing the stubs, all application contexts relevant to this Recommendation | International Standard include ROSE. In addition, each such application context includes one operation-specific ASE concerned with each operation package (including one for the connection package, if there is one).

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Different application contexts can be defined to realize the same association contract by the use of different sets of ASEs to support information transfer. The information transfer ASEs shall be selected to meet the various Quality of Service requirements inherent in the association contract.

NOTE 1 – It is possible that in the future, rules could be defined for determining which ASEs should be involved in order to meet particular Quality of Service (QOS) requirements. However, it is presently assumed that this is a manual process; that is, the designer of a realization takes these requirements into account and chooses the ASEs accordingly.

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All application contexts include ACSE, although this may be acting as the α-ASE or as a supporting ASE.

NOTE 2 – The application context may include additional ASEs for purposes outside of the scope or concern of ROSE, provided that they are arranged to be harmonious with the ASEs mentioned here.

7.2 Application context specification

7.2.1 The static aspects of a ROS-based application context definition can be described as an information object of the class **APPLICATION-CONTEXT**, which is specified as follows:

```
APPLICATION-CONTEXT ::= CLASS
{
        &associationContract            CONTRACT,
        &associationRealization         REALIZATION OPTIONAL,
        &transferRealization            REALIZATION,
        &AbstractSyntaxes               ABSTRACT-SYNTAX,
        &applicationContextName         OBJECT IDENTIFIER UNIQUE
}
WITH SYNTAX
{
        CONTRACT                        &associationContract
        [ESTABLISHED BY                 &associationRealization]
        INFORMATION TRANSFER BY         &transferRealization
        ABSTRACT SYNTAXES               &AbstractSyntaxes
        APPLICATION CONTEXT NAME        &applicationContextName
}

REALIZATION ::= TYPE-IDENTIFIER
```

This definition specifies the ROS aspects of an application context definition. If ASEs other than ROS-based ASEs are used as a part of some application context, the definition in this clause is an element of a composite application context definition.

The manner of defining such a composite application context is outside the scope of this Recommendation | International Standard.

7.2.2 The **&associationContract** field identifies the association contract which this application context realizes.

NOTE – The application designer's intentions regarding whether the "responder can unbind" and "unbind can fail" is derived from the **&associationContract** field.

7.2.3 The **&associationRealization** field shall be present if and only if the **&connection** field of **&associationContract** is present. If present, it shall identify a particular approach to dynamic association establishment and release. A number of such approaches are specified in ITU-T Rec. X.882 | ISO/IEC 13712-3.

7.2.4 The **&transferRealization** field shall identify a particular realization of the information transfer object. A number of such realizations are specified in ITU-T Rec. X.882 | ISO/IEC 13712-3. The **&AbstractSyntaxes** field contains the abstract syntaxes which are required for the conveyance of information between the objects, including the PDUs for invoking and reporting on the operations in the contract. Requirements for these abstract syntaxes are specified in ITU-T Rec. X.882 | ISO/IEC 13712-3. The **&applicationContextName** value shall be used, when the OSI association is being established, to identify the application context which must be in place on this association.

7.3 Relationship with other ASEs and Lower Layer Services

7.3.1 Other Application Service Elements

The ROSE is intended to be used with other ASEs in order to support specific interactive information processing tasks. Therefore, it is expected that the ROSE will be included in a large number of application-context specifications.

The collection of the ROSE and other ASEs included in an application context are required to use the facilities of the presentation-service in a co-ordinated manner among themselves.

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The ROSE requires an existing application association controlled by ACSE.

For some application context specifications, a Reliable Transfer Service Element (RTSE) is included.

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7.3.2 Presentation Service

If an application context including RTSE and ROSE is defined, ROSE services do not use the Presentation service.

If an application context including ROSE but excluding RTSE is defined, the ROSE services require access to the P-DATA service and require the use of the duplex functional unit of the Presentation service. The ROSE services neither use, nor constrain the use of, any other Presentation service.

Identification of the named abstract syntax in use is assumed for all ROSE services, however this is a local matter and outside the scope of this Recommendation | International Standard.

8 Basic ROSE services

The ROSE services are listed in Table 1.

Table 1 – ROSE services

Service	Type
RO-INVOKE	Non-confirmed
RO-RESULT	Non-confirmed
RO-ERROR	Non-confirmed
RO-REJECT-U	Non-confirmed
RO-REJECT-P	Provider-initiated
RO-BIND	Confirmed
RO-UNBIND	Confirmed