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OPEN SYSTEMS INTERCONNECTION CONNECTION-MODE PROTOCOL SPECIFICATIONS

REMOTE OPERATIONS: PROTOCOL SPECIFICATION

ITU-T Recommendation X.229

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation X.229 was published in Fascicle VIII.5 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation X.229

REMOTE OPERATIONS: PROTOCOL SPECIFICATION¹⁾

(Melbourne, 1988)

The CCITT,

considering

(a) that Recommendation X.200 defines the Basic Reference Model of Open Systems Interconnection (OSI) for CCITT Applications;

(b) that Recommendation X.210 defines the service conventions for describing the services of the OSI reference model;

(c) that Recommendation X.216 defines the Presentation Layer service;

(d) that Recommendation X.217 defines the Association Control service;

(e) that Recommendation X.218 defines the Reliable Transfer service;

(f) that Recommendation X.219 defines the Remote Operations service and notation;

(g) that there is a need for common Remote Operations support for various applications,

unanimously declares

that this Recommendation defines the Remote Operations protocol of Open Systems Interconnection for CCITT Applications as given in the Scope and Field of Application.

CONTENTS

0	<i>Introduction</i>
1	<i>Scope and field of application</i>
2	<i>References</i>
3	<i>Definitions</i>
4	<i>Abbreviations</i>
5	<i>Conventions</i>
6	<i>Overview of the Protocol</i>
7	<i>Elements of procedure</i>
8	<i>Mapping to used services</i>
9	<i>Conformance</i>

¹⁾ Recommendation X.229 and ISO 9072-2 [Information processing systems - Text Communication-Remote Operations Part 2: Protocol specification] were developed in close collaboration and are technically aligned.

Annex A - ROPM State Tables

Annex B - Differences between this Recommendation and Recommendation X.410-1984

Annex C - Summary of assigned object identifier values

0 Introduction

This Recommendation specifies the protocol for the services provided by an application-service-element - the Remote Operations Service Element (ROSE) - to support interactive applications in a distributed open systems environment. This Recommendation is one of a set of Recommendations defining sets of application service-elements commonly used by a number of applications.

Interactions between entities of a distributed application are modelled as Remote Operations, and defined using a Remote Operations Notation. A Remote Operation is requested by one entity; the other entity attempts to perform the Remote Operation and then reports the outcome of the attempt. Remote Operations are supported by the ROSE.

This Recommendation is technically aligned with ISO 9072-2.

1 Scope and field of application

This Recommendation specifies the protocol (abstract syntax) and procedures for the Remote Operation Service Element (Recommendation X.219). The ROSE services are provided in conjunction with the Association Control Service Element (ACSE) services (Recommendation X.217) and the ACSE protocol (Recommendation X.227), optionally the Reliable Transfer Service Element (RTSE) services (Recommendation X.218) and the RTSE protocol (Recommendation X.228), and the presentation-service (Recommendation X.216).

The ROSE procedures are defined in terms of:

- a) the interactions between peer ROSE protocol machines through the use of RTSE services or the presentation-service;
- b) the interactions between the ROSE protocol machine and its service-user.

This Recommendation specifies conformance requirements for systems implementing these procedures.

2 References

Recommendation X.200 - Reference model of open systems interconnection for CCITT applications (see also ISO 7498).

Recommendation X.208 - Specification of abstract syntax notation (see also ISO 8824).

Recommendation X.209 - Specification of basic encoding rules for the abstract syntax notation (see also ISO 8825).

Recommendation X.210 - Open systems interconnection layer service definition conventions (see also ISO/TR 8509).

Recommendation X.216 - Presentation service definition for open systems interconnection for CCITT applications (see also ISO 8822).

Recommendation X.217 - Association control service definition for CCITT applications (see also ISO 8649).

Recommendation X.218 - Reliable transfer: model and service definition (see also ISO 9066-1).

Recommendation X.219 - Remote operations: model, notation and service definition (see also ISO 9072-1).

Recommendation X.227 - Association control protocol specification for CCITT applications (see also ISO 8650)

3 Definitions

3.1 *Reference model definitions*

This Recommendation is based on the concepts developed in Recommendation X.200 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) session-service;
- j) session-connection;
- k) transfer syntax; and
- l) user-element.

3.2 *Service conventions definitions*

This Recommendation makes use of the following terms defined in Recommendation X.210:

- 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); and
- j) confirm (primitive).

3.3 *Presentation service definitions*

This Recommendation makes use of the following terms defined in Recommendation X.216:

- a) abstract syntax;
- b) abstract syntax name;
- c) presentation context.

3.4 *Association control definitions*

This Recommendation makes use of the following terms defined in Recommendation X.217:

- a) application-association; association;
- b) application context;
- c) association control service element.

3.5 *Reliable transfer definitions*

This Recommendation makes use of the following terms defined in Recommendation X.218:

- a) reliable transfer service element.

3.6 *ROSE service definitions*

This Recommendation makes use of the following terms defined in Recommendation X.219:

- a) association-initiating-application-entity; association-initiator;
- b) association-responding-application-entity; association-responder;
- c) invoking-application-entity; invoker;
- d) performing-application-entity; performer;
- e) requestor;
- f) acceptor;
- g) linked-operations;
- h) parent-operation;
- i) child-operation;
- j) RO-notation;
- k) remote operation service element;
- l) ROSE-provider;
- m) ROSE-user;
- n) RTSE-user;
- o) remote operations.

3.7 *Remote operation protocol specification definitions*

For the purpose of this Recommendation the following definitions apply:

3.7.1 **remote-operation-protocol-machine:**

The protocol machine for the remote operation service element specified in this Recommendation.

3.7.2 **requesting-remote-operation-protocol-machine:**

The remote-operation-protocol-machine whose service-user is the requestor of a particular remote operation service element service.

3.7.3 **accepting-remote-operation-protocol-machine:**

The remote-operation-protocol-machine whose service-user is the acceptor for a particular remote operation service element service.

4 **Abbreviations**

4.1 *Data units*

APDU application-protocol-data-unit.

4.2 *Types of application-protocol-data-units*

The following abbreviations have been given to the application-protocol-data-units defined in this Recommendation.

ROIV	RO-INVOKE application-protocol-data-unit
RORS	RO-RESULT application-protocol-data-unit
ROER	RO-ERROR application-protocol-data-unit
RORJ	RO-REJECT application-protocol-data-unit

4.3 *Other abbreviations*

The following abbreviations are used in this Recommendation.

AE	application entity
ACSE	association control service element
ASE	application service element
RO (or ROS)	remote operations
ROPM	remote operations protocol machine
ROSE	remote operations service element
RT	reliable transfer
RTSE	reliable transfer service element

5 **Conventions**

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

M	presence is mandatory
U	presence is a ROSE-user option
req	source is related request primitive
ind	sink is related indication primitive
resp	source is related response primitive
conf	sink is related confirm primitive
sp	source or sink is the ROM

The structure of each ROSE APDU is specified in clause 9 using the abstract syntax notation of Recommendation X.208.

6 Overview of the protocol

6.1 Service provision

The protocol specified in Recommendation provides the ROSE services defined in Recommendation X.219. These services are listed in Table 1 /X.229.

TABLE 1/X.229

ROSE services summary

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

6.2 Use of services

The ROSE protocol specified in this Recommendation needs a transfer service to pass information in the form of ROSE APDUs between peer application-entities (AEs).

Two transfer services may be used alternatively:

- the RTSE services, if the RTSE is included in the application-context; or
- the presentation-service, if the RTSE is not included in the application-context.

In both cases, an existing application-association, established and released by means of the ACSE services, is assumed.

6.2.1 Use of the RTSE services

If the RTSE is included in the application-context, this Recommendation assumes that the ROPM is the sole user of the RT-TRANSFER service and the RT-TURN-GIVE service.

The initiating AE may only request the release of the application-association by means of the RT-CLOSE service if it possesses the turn. Therefore the RTSE-user and the ROPM are the user of the RT-TURN-PLEASE service.

The ROPM is the user of the RT-U-ABORT and RT-P-ABORT services.

6.2.2 Use of the presentation-service

If the RTSE is not included in the application context, the ROPM is a user of the P-DATA service.

6.3 Model

The remote-operation-protocol-machine (ROPM) communicates with its service-user by means of primitives defined in Recommendation X.219. Each invocation of the ROPM controls a single application-association.

The ROPM is driven by ROSE service request primitives from its service-user, and by indication and confirm primitives of the RTSE services, or the presentation-service. The ROPM, in turn, issues indication primitives to its service-user, and request primitives on the used RTSE services, or the presentation-service. If the RTSE is included in the application-context, the RT-TRANSFER indication, RT-TRANSFER request and RT-TRANSFER confirm primitives are used. In the case of an application-context excluding RTSE, the presentation-service P-DATA request, and P-DATA indication primitives are used. In this case the transfer is not confirmed.

The reception of an ROSE service primitive, or of an RTSE service or of a presentation-service primitive, and the generation of dependent actions are considered to be individual.

During the exchange of APDUs, the existence of both, the association-initiating AE and the association-responding AE is presumed. How these AEs are created is beyond the scope of this Recommendation.

During the execution of operations, the existence of an application-association between the peer AEs is presumed. How this application-association is established and released is beyond the scope of this Recommendation (see Recommendations X.219, X.217, X.227, X.218 and X.228).

Note - Each application-association may be identified in an end system by an internal, implementation dependent mechanism so that the ROSE service-user and the ROPM can refer to it.

7 Elements of procedure

The ROSE protocol consists of the following elements of procedure:

- a) invocation;
- b) return-result;
- c) return-error;
- d) user-reject;
- e) provider-reject.

In the following clauses, a summary of each of these elements of procedure is presented. This consists of a summary of the relevant APDUs, and high-level overview of the relationship between the ROSE service primitives, the APDUs involved, and the transfer service that is used.

The generic terms transfer service, transfer service-provider, transfer request, and transfer indication are used in the context of clause 7. Clause 8 describes how these generic service primitives are mapped either on to the RTSE services or the presentation-service.

In clause 9 a detailed specification of the ROSE APDUs is given using the notation defined in Recommendation X.208.

7.1 *Invocation*

7.1.1 *Purpose*

The invocation procedure is used by one AE (the invoker) to request an operation to be performed by the other AE (the performer).

7.1.2 *APDUs used*

The invocation procedure uses the RO-INVOKER (ROIV) APDU.

The fields of the ROIV APDU are listed in Table 2/X.229.

TABLE 2/X.229
ROIV APDU fields

Field name	Presence	Source	Sink
Invoke-ID	M	req	ind
Linked-ID	U	req	ind
Operation-value	M	req	ind
Argument	U	req	ind

7.1.3 *Invocation procedure*

This procedure is driven by the following events:

- a) an RO-INVOKE request primitive from the requestor;
- b) an ROIV APDU as user-data of a transfer indication primitive.

7.1.3.1 *RO-INVOKE request primitive*

The requesting ROPM forms an ROIV APDU from the parameter values of the RO-INVOKE request primitive. It issues a transfer request primitive. The user-data parameter of the transfer request primitive contains the ROIV APDU.

The requesting ROPM waits either for a transfer indication primitive from the transfer service-provider or any other primitive from the requestor.

7.1.3.2 *ROIV APDU*

The accepting ROPM receives an ROIV APDU from its peer as user-data on a transfer indication primitive. If any of the fields of the ROIV APDU are unacceptable to this ROPM, the provider-reject procedure is performed, and no RO-INVOKE indication primitive is issued by the ROPM.

If the ROIV APDU is acceptable to the accepting ROPM, it issues an RO-INVOKE indication primitive to the acceptor. The RO-INVOKE indication primitive parameters are derived from the ROIV APDU.

The accepting ROPM waits either for a transfer indication primitive from the transfer service-provider or any other primitive from the acceptor.

7.1.4 *Use of the ROIV APDU fields*

The ROIV fields are used as follows.

7.1.4.1 *Invoke-ID*

This is the Invoke-ID parameter value of the RO-INVOKE request primitive. It appears as the Invoke-ID parameter value of the RO-INVOKE indication primitive.

The value of this field is transparent to the ROPM, however the value may be used in the provider reject procedure.

7.1.4.2 *Linked-ID*

This is the Linked-ID parameter value of the RO-INVOKE request primitive. It appears as the Linked-ID parameter value of the RO-INVOKE indication primitive.

The value of this field is transparent to the ROPM.

7.1.4.3 *Operation-value*

This is the Operation-value parameter value of the RO-INVOKE request primitive. It appears as the Operation-value parameter value of the RO-INVOKE indication primitive.

The value of this field is transparent to the ROPM.

7.1.4.4 *Argument*

This is the Argument parameter value of the RO-INVOKE request primitive. It appears as the Argument parameter value of the RO-INVOKE indication primitive.

The value of this field is transparent to the ROPM.