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Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services

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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.

International Standard ISO/IEC 10731 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.210.

Annexes A, B, C, D, E and F of this International Standard are for information only.

Introduction

The service conventions prescribed in this International Standard ensure that the services of OSI standards are defined in a uniform way, which is consistent with the OSI Reference Model and the application layer structure standard. The text was developed jointly with ITU-T. The main intent of this International Standard is to provide extended capabilities, which are useful in specifying services within the application layer and also to allow greater flexibility to accommodate new services among the layers in the future.

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY — OPEN SYSTEMS INTERCONNECTION — BASIC REFERENCE MODEL — CONVENTIONS FOR THE DEFINITION OF OSI SERVICES

1 Scope

This Recommendation | International Standard

- establishes definitions of terms and conventions for use by Recommendations | International Standards defining OSI-services within the scope of the Basic Reference Model of Open Systems Interconnection;
- specifies the application of these terms and conventions to the Recommendations | International Standards defining OSI-services within the Application Layer of the Basic Reference Model of Open Systems Interconnection;
- specifies the application of these terms and conventions to Recommendations | International Standards defining (N)-services for Layers 1 - 6 of the Basic Reference Model of Open Systems Interconnection.

2 Normative references

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

2.1 Identical Recommendations and International Standards

- ITU-T Recommendation X.207 (1993) | ISO/IEC 9545: 1993, *Information Technology – Open Systems Interconnection – Application Layer structure.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1988), *Reference model of open systems for CCITT applications.*
- ISO/IEC 7498:1984, Information technology – *Open Systems Interconnection – Basic Reference Model.*

3 Definitions

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

3.1 Terms defined in the OSI Basic Reference Model

This Recommendation | International Standard builds on the concepts developed in CCITT Rec. X.200 | ISO 7498 and makes use of the following terms defined in that Recommendation | International Standard:

a) (N)-connection;

b) (N)-connection-endpoint;

c) (N)-entity;

d) (N)-layer;

e) open system;

f) (N)-service;

g) (N)-service-access-point;

h) (N)-subsystem.

3.2 Terms defined in the Application Layer Structure

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.207 (1993) | ISO/IEC 9545:

a) application-entity-invocation;

b) application-service-element;

c) application-service-object;

d) control function.

3.3 Terms defined in this Recommendation | International Standard

NOTE – Several terms in the following list are structured with the prefix "OSI-". The terms thus prefixed are intended to have a consistent meaning across all layers of OSI, including the Application Layer.

In the case of the OSI-services provided by the six lower layers, the prefix "OSI-" can be replaced by the equivalent prefix "(N)-" which particularises the concept to the generic (N)-layer.

Further particularisation is needed in other OSI standards, such as replacing "OSI-" with the abbreviation for one of the six lower layers, or replacing "OSI-" with the abbreviation for a particular application-service-element or group of application-service-elements which provide an OSI-service within the Application Layer.

3.3.1 OSI-service: The capability of an OSI-service-provider which is provided to OSI-service-users at the boundary between the OSI-service-provider and the OSI-service-users.

NOTE – The OSI-service defines the external behaviour of the OSI-service-provider independent of the mechanisms used to provide that behaviour. (N)-layers, (N)-entities, application-service-elements, etc. are components of an OSI-service-provider.

3.3.2 OSI-service-provider: An abstract representation of the totality of those entities which provide an OSI-service to OSI-service-users.

3.3.3 OSI-service-user: An entity in a single open system that makes use of an OSI-service.

NOTE – The OSI-service-user makes use of the OSI-service through a collection of OSI-service primitives defined for the OSI-service.

3.3.4 OSI-service primitive; primitive: An abstract, atomic, implementation-independent representation of an interaction between an OSI-service-user and its OSI-service-provider.

NOTE – The term "primitive" is used in some documents in place of the preferred form "OSI-service primitive".

3.3.5 submit (primitive): An OSI-service primitive initiated by an OSI-service-user.

3.3.6 deliver (primitive): An OSI-service primitive initiated by an OSI-service-provider.

3.3.7 requestor: In a particular exchange of OSI-service-primitives, an OSI-service-user that issues a submit primitive and as a result may receive one or more deliver primitives.

3.3.8 acceptor: In a particular exchange of OSI-service-primitives, an OSI-service-user that receives a deliver primitive and as a result may issue one or more submit primitives.

3.3.9 request (primitive); requestor.submit (primitive): A submit primitive issued by a requestor.

3.3.10 indication (primitive); acceptor.deliver (primitive): A deliver primitive received by an acceptor.

3.3.11 response (primitive); acceptor.submit (primitive): A submit primitive issued by an acceptor.

3.3.12 confirm (primitive); requestor.deliver (primitive): A deliver primitive received by a requestor.

3.3.13 OSI-facility: A part of an OSI-service designated within a Recommendation | International Standard.

NOTES

1 There are existing Recommendations | International Standards for OSI-service definitions which use the form "...-service" for terms relating to such a designated part of the total OSI-service. The form "...-facility" is to be strongly preferred for all such usages.

2 The term "OSI-facility" defined here is distinguished from the term "facility" (without the qualification "OSI-") used, for example, in CCITT Rec. X.25 and ISO/IEC 8208.

3.3.14 OSI-mandatory-facility: An OSI-facility which is always provided.

3.3.15 OSI-provider-optional-facility: An OSI-facility which may or may not be provided.

3.3.16 OSI-user-optional-facility: An OSI-facility which is only used if all peer OSI-service-users agree.

3.3.17 OSI-confirmed-facility: An OSI-facility in the operation of which an explicit confirmation is given from the OSI-service-provider to the initiating OSI-service-user.

3.3.18 OSI-non-confirmed-facility: An OSI-facility in the operation of which no explicit confirmation is given from the OSI-service-provider to the initiating OSI-service-user.

3.3.19 OSI-provider-initiated-facility: An OSI-facility the operation of which is initiated by the OSI-service-provider.

3.3.20 OSI-local view: The shared behaviour of an OSI-service-user and an OSI-service-provider in terms of their interactions at an OSI-service boundary.

NOTE – In the case of (N)-services, the OSI-service boundary is to be understood as the set of (N)-service-access-points for the (N)-subsystem.

3.3.21 symmetrical service: An OSI-service for which the definitions of all OSI-local views are the same (i.e. there is only one type of OSI-local view).

3.3.22 asymmetrical service: An OSI-service for which the definitions of all OSI-local views are not all the same (i.e. there are several types of OSI-local view).

3.3.23 multi-peer: A mode of operation of an OSI-service which supports exchanges between more than two OSI-service-users.

4 Abbreviations

ASE application-service-element

ASO application-service-object

OSI Open Systems Interconnection

SECTION 1 – GENERAL MODEL AND CONVENTIONS

5 Model of service

5.1 The concept of OSI-service definition

5.1.1 An OSI-service is that capability of an OSI-service-provider which is offered to OSI-service-users at the boundary between the OSI-service-provider and the OSI-service-users.

5.1.2 An OSI-service definition is the complete expression of the behaviour of an OSI-service-provider as seen by its OSI-service-users. An OSI-service definition does not describe the internal behaviour of an OSI-service-provider. There are many mechanisms that may be specified to provide an OSI-service. It is thus fundamental that the conventions used to define an OSI-service allow an OSI-service definition to be expressed totally independently from any subsequent specification of the protocol or protocols which support that OSI-service.

5.1.3 To make proper use of an OSI-service, it is necessary for an OSI-service-user to reference the OSI-service definition. As a result, an OSI-service definition constrains the behaviour of the OSI-service-users. Nevertheless, it is not the purpose of an OSI-service definition to express the complete behaviour of OSI-service-users.

5.2 The general model of an OSI-service definition

5.2.1 This clause describes a general model for the definition of an OSI-service which is applicable to all modes of communication (connectionless-mode, connection-mode, multi-peer, etc.) in all seven layers.

5.2.2 An OSI-service-user and an OSI-service-provider interact at a OSI-service boundary in an open system. The interactions between the OSI-service-user and the OSI-service-provider constitute an abstract interface at the OSI-service boundary. This abstract interface is the OSI-local view. The OSI-local view is defined in terms of the set of OSI-service primitives which the OSI-service user and the OSI-service-provider are allowed to exchange, together with the sequencing rules which apply to these exchanges.

5.2.3 An OSI-service primitive issued by an OSI-service-user to its OSI-service-provider is a definition of:

a) the semantics of the information conveyed by the OSI-service primitive;

b) the constraints imposed on the OSI-service-user in order to issue the OSI-service primitive; and

c) the requirements for action that the OSI-service-provider shall meet as a result of receiving the OSI-service primitive.

5.2.4 An OSI-service primitive issued by an OSI-service-provider to one of its OSI-service-users is a definition of:

a) the semantics of the information conveyed by the OSI-service primitive;

b) the conditions to be fulfilled by the OSI-service-provider in order to issue the OSI-service primitive; and

c) the possible expectations of the OSI-service-provider regarding the reactions of the OSI-service-user resulting from its receipt of the OSI-service primitive.

5.2.5 The semantics of these OSI-service primitives and the complete set of relationships among OSI-local views are described in a model which defines the virtual environment in which the OSI-service applies. A relationship exists among OSI-local views when there is a correlation among OSI-service primitives at each of these several OSI-local views.

NOTES

1 In some cases, the model is explicitly described in a standard, in other cases (e.g. (N)-layer-services) the model may be implicitly known.

2 The semantics of the OSI-service primitives may be described, for example, in terms of abstract actions on abstract objects.

3 In a simple case, the model of a peer-to-peer OSI-service establishes a one to one correspondence between the two OSI-local views; in a more complex case, the model of an OSI-service may establish a one to many correspondence among some of the OSI-local views participating in the OSI-service.

5.2.6 An OSI-service definition comprises:

a) the definition of, or reference to, the model introduced in 5.2.5;

b) the definition of the OSI-local views of relevance to the OSI-service (these definitions may all be the same: symmetrical service, or they may not: asymmetrical service);

c) the definition of the correlation among OSI-service primitives for this set of OSI-local views.

5.2.7 The definition of the correlation among OSI-service primitives is itself formed by the following three components:

a) the definition of, or reference to, the model introduced in 5.2.5

b) the definition of the relationships among OSI-service primitives within the scope of each OSI-local view;

c) based on the relationships among OSI-local views, the definition of the correlations among OSI-service primitives that pertain to separate (but related) OSI-local views.

NOTES

1 Aspects of such a definition of the correlations among OSI-service primitives seen by different OSI-service-users include

– the definition of the relationships among submit primitives originated at one OSI-local view and deliver primitives issued at other related OSI-local views;

– the definition of the effects of possible collisions among submit primitives originated at one OSI-local view with submit primitives originated at other, related OSI-local views, etc.

2 Only the OSI-local view is visible to the OSI-service-user. A specific OSI-service-user is only concerned with the exchange of OSI-service primitives at the OSI-service boundary for this OSI-local view. The possible correlation between the OSI-service primitives seen by different OSI-service-users does not need to be known by them and, consequently, is expressed in the correlation definition and not in the definitions of the separate OSI-local views.

3 The definition of the correlations among OSI-service primitives seen by different OSI-service users is a high-level definition. For example, although in a particular case a correlation definition might specify that an information request primitive from one OSI-service-user results in the receipt of information request primitives by a number of OSI-service-users holding the information to be accessed, it would not specify how the OSI-service-users are located nor how the requests are routed to them.

5.2.8 There are two basic types of OSI-service primitive: the submit primitive invoked by the OSI-service-user to exchange information with the OSI-service-provider, and the deliver primitive invoked by the OSI-service-provider to exchange information with the OSI-service-user.

5.2.9 Figure 1 illustrates an idealized view of a complete composite OSI-service. This composite OSI-service consists of several OSI-service primitives which, when executed successfully in the correct sequence, result in the objective of the initiating OSI-service-user.

NOTES

1 Figure 1 illustrates four OSI-service-users, of which three are participating in an exchange of OSI-service primitives with the OSI-service-provider. Only the corresponding OSI-local view is apparent to an OSI-service-user.

2 While it is convenient to view the OSI-service-provider as one unit for the purposes of illustration, it must not be overlooked that it is a distributed system. This means that the OSI-service-provider cannot be considered a single state machine; that there are time delays between service actions, and that there exists the possibility of loss, error, and misordering associated with real communication.

3 If Figure 1 is reproduced in an actual OSI-service standard, it should be accompanied by explanatory text similar to 5.2.9 and Note 2.

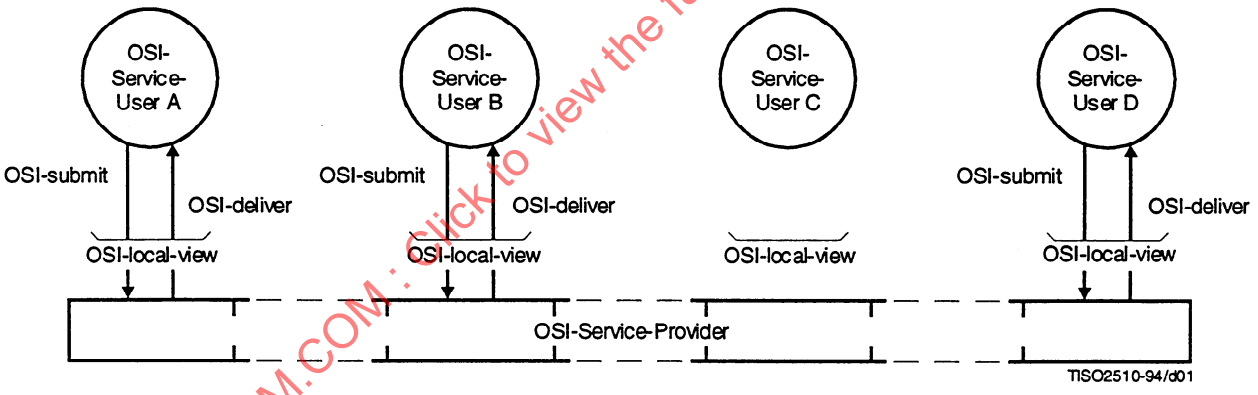


Figure 1 – OSI-service model

5.2.10 At a given point in time, the state of the OSI-local view of an OSI-service is completely determined by the preceding sequence of OSI-service primitives that has been observed at the OSI-service boundary.

5.2.11 Deliver primitives issued at an OSI-local view are usually correlated to submit primitives invoked by OSI-service-users at other OSI-local views. In some specific cases (e.g. provider initiated) a deliver primitive may be issued without any submit primitive having been invoked at any other OSI-local view.

5.2.12 An OSI-service definition contains one or more definitions of OSI-local views. Where there is only one definition of OSI-local views, the OSI-service is said to be symmetrical and needs no additional identification. Correspondingly, when an OSI-service is asymmetrical, it requires names to distinguish OSI-local views having different definitions. These names need only be unique within the OSI-service definition, but should be chosen to facilitate understanding (e.g. CLIENT and SERVER in Annex E).

5.3 The concepts of requestor and acceptor

5.3.1 An OSI-service-user that issues a submit primitive and as a result may receive one or more deliver primitives is, for that exchange of OSI-service primitives, called a requestor.

5.3.2 An OSI-service-user that receives a deliver primitive and as a result may issue one or more submit primitives is, for that exchange of OSI-service primitives, called an acceptor.

5.3.3 An OSI-service-user can have the requestor role for some of the interactions and the acceptor role for others.

NOTE – The constraints on the behaviour of the OSI-service-user or OSI-service-provider are entirely determined by the specific OSI-service primitives issued or invoked and the state of the OSI-service-user or OSI-service-provider as appropriate.

5.4 Categories of facilities within an OSI-service

Parts of an OSI-service can be categorized as

a) OSI-mandatory-facilities;

b) OSI-provider-optional-facilities;

c) OSI-user-optional-facilities.

An OSI-user-optional-facility may be either an OSI-provider-optional-facility or an OSI-mandatory-facility, i.e. an OSI-facility mandatory for the provider but optional for the user.

5.5 Application of the model to various types of communication

5.5.1 The connectionless-mode service

For the basic operation of a connectionless-mode service:

a) a submit primitive is always issued by a requestor OSI-service-user and is called a request primitive;

b) a deliver primitive is always issued to an acceptor OSI-service-user and is called an indication primitive; and

c) the relationship is specified between a submit primitive issued by a requestor and a deliver primitive issued to one or more acceptors.

NOTE – This description does not preclude the definition of OSI-service primitives for additional operations in some connectionless-mode services.

5.5.2 The connection-mode service

In a connection-mode service

a) a submit primitive may be issued either by a requestor or by an acceptor OSI-service-user;

   1) a requestor.submit primitive is called a request primitive;

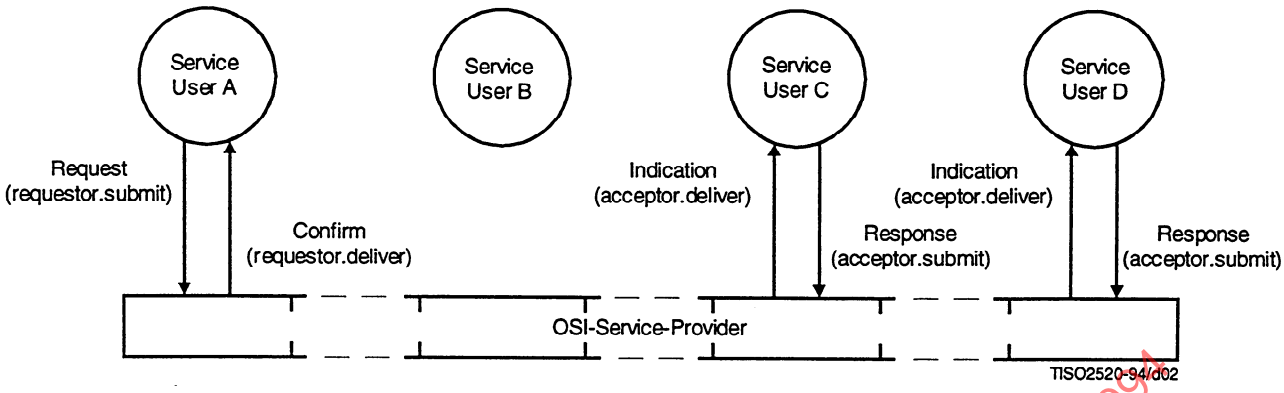
   2) an acceptor.submit primitive is called a response primitive;

b) a deliver primitive may be issued either to a requestor or to an acceptor OSI-service-user;

   1) a requestor.deliver primitive is called a confirm primitive;

   2) an acceptor.deliver primitive is called an indication primitive;

c) the relationship is specified between submit primitives issued by a requestor or by an acceptor, and deliver primitives issued to a requestor or to one or more acceptors. Figure 2 illustrates a multi-peer connection-mode service; Figure 3 illustrates a peer-to-peer connection-mode service. The relationships of the terms request, confirm, indication, and response to the requestor/acceptor, submit/deliver terms are shown.



NOTE – The correlations between the OSI-primitives represented in this figure depend upon the specific service defined and the semantics of the OSI-service primitives. For some cases:

a) both Indication-service primitives will be correlated with the Request-service primitive, and

b) the Confirmation-service primitive will be correlated with both Response-service primitives.

Figure 2 – Example of a multi-peer connection-mode service

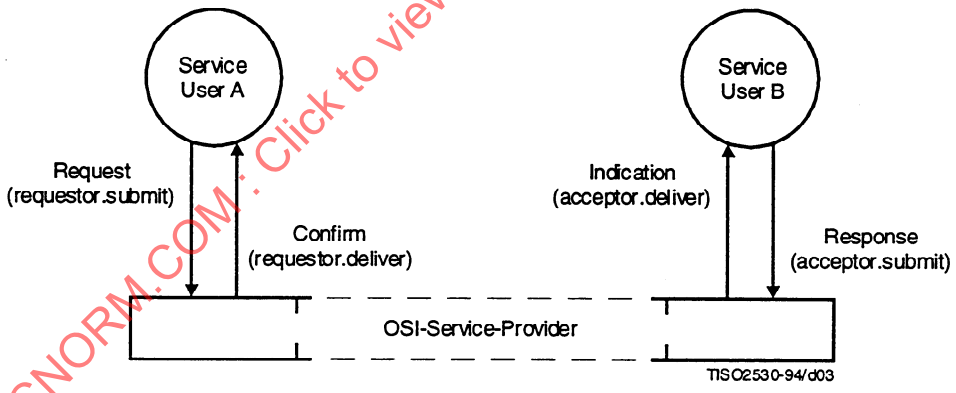


Figure 3 – Example of a peer-to-peer connection-mode service

NOTE – For the meanings of the terms request, indication, response and confirmation used in figures 2 and 3 see 6.3.2.

6 Structure of OSI-service primitives

6.1 OSI-service primitives

To describe an OSI-service primitive fully, its type name and the list of its parameters must be given. For the purposes of description, an OSI-service primitive can be represented as a tuple of these values, e.g.

$$\text{ServiceType}(\text{param}_1, \ldots, \text{param}_n)$$

NOTE – Each parameter may represent OSI-service control information or OSI-service user data.

The definition of an OSI-service in terms of OSI-service primitives does not imply any specific implementation of an OSI-service-provider. The following comments apply to the definition technique based on OSI-service primitives:

a) An OSI-service primitive is an abstraction, and so does not imply:

   – any implementation-specific mechanism for invoking the OSI-service;

   – any direct relationship to a protocol element.

b) Only OSI-service primitives which relate to some element of the OSI-service involving OSI-service-users in the OSI environment need to be considered. The interactions which are related only to local conventions between the OSI-service-user and OSI-service-provider do not have to be considered in an OSI-service definition. For example, strictly local functions could be provided in some implementations. As they do not involve other OSI-service-users, such functions are not visible outside the local system.

6.2 Properties of OSI-service primitives

The interaction described by an OSI-service primitive is to be regarded as taking place as an instantaneous event which cannot be interrupted by another interaction. An OSI-service primitive has associated with it:

a) a direction which may be

   1) from an OSI-service-user to the OSI-service-provider; or

   2) from the OSI-service-provider to an OSI-service-user,

   indicating the main flow of information;

b) one or more parameters, each having a defined range of values. The values associated with an interaction described by an OSI-service primitive are passed in either direction as appropriate for a given OSI-service primitive. (It is permitted for information to be passed in the opposite direction to the direction in which the OSI-service primitive is passed.)

6.3 Names of OSI-service primitives

6.3.1 The two basic types of OSI-service primitive may be qualified to identify sub-types, e.g. in order to reflect correlations among OSI-service primitives at the same OSI-local view or at different OSI-local views. Hence names of OSI-service primitives are structured as follows:

<name of service primitive> ::= <service-name> - <service-primitive-name> . <primitive-type>,

where

<primitive type> ::= <basic primitive> | <primitive sub-type> . <basic-primitive>.

<service-name> identifies the (N)-layer or the component of the Application Layer providing the OSI-service (see A.1).

<service-primitive-name> identifies the facility to which the OSI-service primitive belongs (e.g. CONNECT) (see A.2).

<basic-primitive> specifies whether the OSI-service primitive is of the type SUBMIT or DELIVER.

<primitive-sub-type> allows for a refinement of the OSI-service primitive type (e.g. REQUESTOR | ACCEPTOR | ...) (see A.3).

6.3.2 This structure of names of OSI-service primitives is a general one which may be simplified where appropriate. In particular, where necessary to ensure consistency with established use, <primitive sub-type>.<basic primitive> is abbreviated to a simple name in the following cases:

- Request used in place of requestor.submit;
- Indication used in place of acceptor.deliver;
- Response used in place of acceptor.submit;
- Confirm used in place of requestor.deliver.

6.4 OSI-service primitive parameters

6.4.1 OSI-service definition standards do not stipulate constraints on sequencing of parameters of OSI-service primitives.

6.4.2 This Recommendation | International Standard does not stipulate the use of any particular technique for describing parameters of OSI-service primitives.

7 OSI-service definition techniques

7.1 Definition of OSI-local views and their relations

7.1.1 The definition of the set of OSI-local views relevant to an OSI-service definition requires the definition of the set of possible states (the state-set) for each OSI-local view. The state-set for a given OSI-local view is determined by the possible sequences of OSI-service primitives which may occur at the OSI-service boundary for that OSI-local view. The possible sequences of OSI-service primitives are constrained by the model which determines the semantics of the OSI-service primitives, and by the correlations between the OSI-service primitives at the given OSI-local view and the OSI-service primitives at other relevant OSI-local views.

7.1.2 Even though the relationships among OSI-local views may take complex forms, it is possible to determine the state of the OSI-local view for a particular relationship between two OSI-local views. The OSI-local view is then fully defined by the collection of the state-sets of the OSI-local view for each of the relationships in which it is involved.

7.1.3 From the perspective of the relationship between two OSI-local views, the sequence of OSI-service primitives at the OSI-service boundary for this OSI-local view may result in an exchange of OSI-service primitives, either

- at the peer OSI-local view; or
- at the other OSI-local views with which this OSI-local view has a relationship; or
- both.

7.1.4 The definition of the state-set of an OSI-local view for a specific relationship provides an exact and complete representation of the semantic exchanges between the OSI-service-users involved in that relationship while taking into account other exchanges that pertain to relationships between this OSI-local view and other OSI-local views.

7.1.5 The state-set description of an OSI-local view for a specific relationship is thus defined on the basis of events that occur:

a) within the bounds of that specific relationship;

b) within the bounds of other relationships involving this OSI-local view. These particular events need only to be represented as they affect the state of this particular OSI-local view as perceived from the perspective of that specific relationship. Hence it may happen that several of these events may be collapsed at a higher level of abstraction so that they only result in one global effect on that specific relationship.

7.1.6 The global state-set description of an OSI-local view is then formed by the collection of state-set descriptions associated with each of the relationships in which the OSI-local view is involved.

7.2 Conventions for time-sequence diagrams

7.2.1 Time-sequence diagrams may be used to illustrate how sequences of interactions are related in time.

Time-sequence diagrams indicate:

a) the sequence of events at an OSI-local view; and

b) where appropriate, the sequence of events between different OSI-service-users.

7.2.2 Time-sequence diagrams do not provide a complete and unambiguous description of an OSI-service. They are aimed at clarifying, mostly through the use of examples, the most complex aspects of an OSI-service.

7.2.3 The general model of a time sequence diagram comprises:

a) at the top of the diagram, a representation of the various OSI-local views (e.g. a set of circles) with their identification for reference purposes; where useful, the diagram indicates the relationships existing among OSI-local views by means of lines joining the circles representing these OSI-local views.

b) under each representation of an OSI-local view, a vertical line, indicating, from top to bottom, the passage of time, so that the sequence of events at each OSI-local view in terms of OSI-service primitives can be positioned along the appropriate vertical line in time order down the page.

NOTE – For simple cases there is no need for the representation of the OSI-local views at the top of the diagram.

7.2.4 The following conventions are used for the representation of OSI-service primitives:

a) An OSI-service primitive is represented by an arrow.

b) Arrows located at the left of the vertical line indicate requestor primitives.

c) Arrows located at the right of the vertical line indicate acceptor primitives.

d) Arrows directed towards the vertical line indicate submit primitives.

e) Arrows directed out of the vertical line indicate deliver primitives.

f) An OSI-service primitive name is associated with each arrow.

g) Where there is a possible ambiguity about the correlations among OSI-service primitives at various OSI-local views, this ambiguity is removed through the use of some or all of the following techniques:

- Where possible (i.e. if this does not lead to a diagram which is over complex and unreadable), a (dotted) line between arrows located at the different OSI-local views indicates that OSI-service primitives associated with these arrows are correlated.
- An identification of all OSI-local views concerned with an OSI-service primitive is associated with the arrow representing this OSI-service primitive (either identifying these OSI-local views one by one or by reference to a pre-defined name list).
- A reference number is associated with the representation of requestor-type OSI-service primitives. The same reference number is associated with the representation(s) of the related acceptor type OSI-service primitives.

Where additional information is needed, this can be presented by means of notes associated with the diagram.

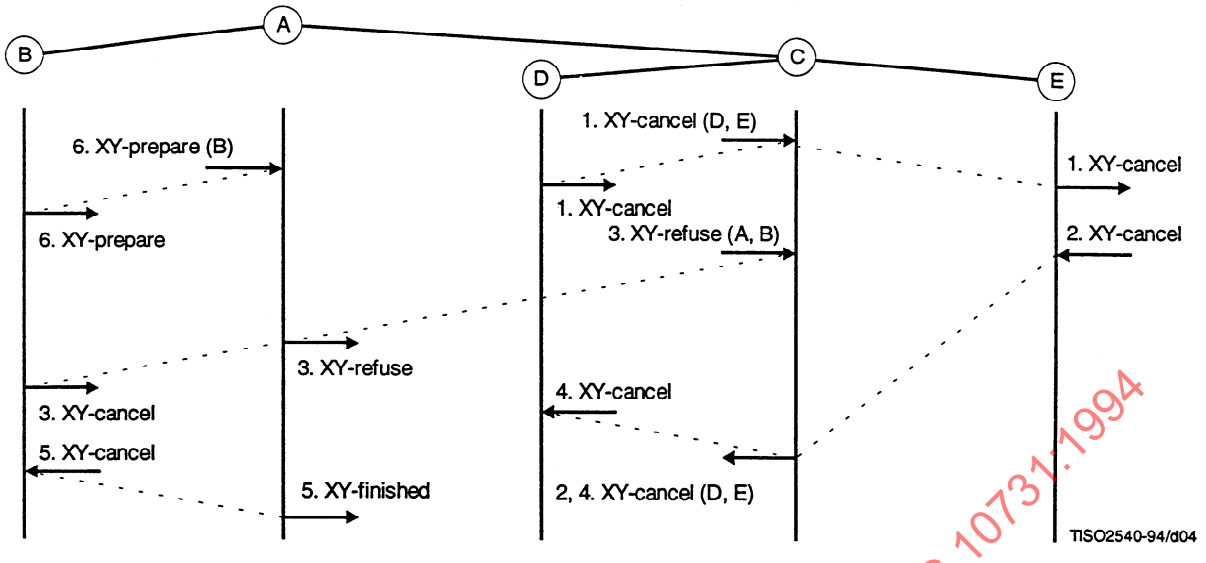
7.2.5 Figure 4 shows these conventions in use in a time-sequence diagram for part of a general, fictitious, multi-party service.

7.2.6 Figure 5 shows these conventions in use in a time sequence diagram for the simple two-party case. This is consistent with the representation currently used in some OSI-service definitions for layers 1-6, with the convention that the requestor is always shown on the left of the diagram.

NOTES

1 In the two-party case, and where appropriate to the illustration of a particular facility, the area between the vertical lines may be regarded as representing activity in the OSI-service provider, and the area outside the vertical lines as representing activity in the OSI-service users.

2 Additional and alternative representations are also in use in OSI-service definitions for layers 1-6. For information, these are shown in Annex D.



NOTES

1 XY-cancel is requested by C, with D and E as acceptors. It is a confirmed facility, and C does not receive the XY-cancel confirm until both D and E have replied. C also requests XY-refuse, which is a single association nonconfirmed facility to the superior A. At A, this appears as XY-refuse, but it automatically propagates to B where it appears as an XY cancel indication. When the reply from B comes back, the indication only XY-finished is issued to the root node A. An XY-prepare from A to B is also shown.

2 For illustrative purposes the techniques described in 7.2.4 g) are used in this figure to express the correlations among OSI, local views. Such a combination of techniques would not normally be appropriate in practise.

Figure 4 – Example of a time-sequence diagram for a general, fictitious, multi-party service

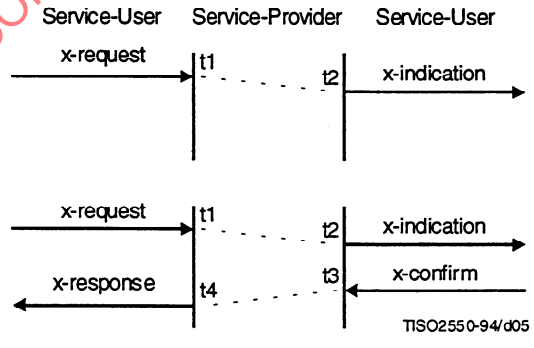


Figure 5 – Time sequence diagrams for the simple two-party case

SECTION 2 – THE APPLICATION LAYER

8 Model of OSI-service for the Application Layer

8.1 An OSI-service defined by an Application Layer standard is provided by an application-service-object (ASO) at any level of the structure permitted by ITU-T Rec. X.207 (1993) | ISO/IEC 9545 (including the case of an ASO composed of a single ASE).

8.2 The general conventions defined in this Recommendation | International Standard apply for Application Layer standards. There are no special Application Layer conventions required for defining the OSI-service at any level. In particular, the way an OSI-local view is defined and the way OSI-local views are correlated are independent of level of composition, and follow the general conventions defined in this Recommendation | International Standard.

NOTE – ITU-T Rec. X.207 (1993) | ISO/IEC 9545 describes how various components of the Application Layer can be combined to provide a resultant OSI-service (e.g. the combination of ASEs and/or ASOs together with control functions to form an ASO). Any such combination is not visible within the resultant OSI-service.

How the OSI-service which is provided through the combination of elements internal to the ASO is achieved is not part of the OSI-service definition. In particular, the OSI-service definition does not take account of whether the OSI-service is derived through a combination of ASOs and/or ASEs or direct use of Presentation Layer services.

9 OSI-service primitives in the Application Layer

The general conventions for OSI-service primitives as set out in clause 6 of this Recommendation | International Standard apply to the Application Layer.

9.1 Names of OSI-service primitives in the Application Layer

In the Application Layer, developers of Recommendations | International Standards should use letter abbreviations for the service-name component (see 6.3) of the name of an OSI-service primitive. Such letter abbreviations should be chosen from those that are not already in current use. (See A.1.)

NOTE – Annex A provides a list of service-name components in current use. This list is updated at each revision of this Recommendation | International Standard.

SECTION 3 – LAYERS 1-6

10 Model of OSI-service for layers 1-6

The general model described in 5.2 is applicable to the lower six layers of the Basic Reference Model. For the (N)-connection-mode peer-to-peer service already used in existing Recommendations | International Standards, the complete set of OSI-local views reduces to two. This reduced model (depicted in Figure 3) is equivalent to the model used in existing Recommendations | International Standards, where the terms request, confirm, indication and response as defined in 6.3.2 are used. Examples of the time-sequence diagrams defined in 7.2 for the (N)-connection-mode peer-to-peer service are shown in Figure 5. Additional and alternative representations are also in use in OSI-service definitions for layers 1-6. For information, these are shown in Annex D.

11 OSI-service primitives in layers 1-6

The general conventions for OSI-service primitives as set out in clause 6 of this Recommendation | International Standard apply to the lower six layers.

11.1 Names of OSI-service primitives in layers 1-6

In the (N)-layer, developers of Recommendations | International Standards should use an initial (or initials) which specifies the layer for the service-name component (see 6.3) of the name of an OSI-service primitive. (See A.1.)

Annex A
Conventions for naming OSI-service primitives

(This annex does not form an integral part of this Recommendation | International Standard)

NOTE – This annex provides information for the authors of OSI-service definitions but is not necessary for users of OSI-service definitions.

A.1 Service-user-name

Initials are used to specify the service-name component. The following is a non-exhaustive list of abbreviations used for the Application Layer:

A Association Control Service Elements (ACSE)

F File Transfer, Access, and Management ASE (FTAM)

V Virtual Terminal ASE (VTP)

J Job Transfer and Manipulation ASE (JTM)

TP Distributed Transaction Processing

C Commitment, Concurrency and Recovery ASE (CCR)

R Remote Database Access ASE (RDA)

OR Remote Operations Service ASE (ROSE)

The following initials are used to specify the lower six layers of the OSI model:

P Presentation Layer;

S Session Layer;

T Transport Layer;

N Network Layer (see Note);

DL Data Link Layer;

Ph Physical Layer.

NOTE – The use of "N" to signify the Network Layer is not to be confused with the use of "(N)-" to signify a particular but unspecified layer of the Model.

A.2 Service-primitive-name

A single word, consisting of the indicative form of a verb is recommended for the service-primitive-name (e.g. CONNECT | SYNCHRONIZE | ...).

A.3 OSI-service primitive type

A single word is recommended for the <primitive sub-type> component (e.g. REQUESTOR | ACCEPTOR | ...).

The basic-primitive component consists of one of the following:-

a) SUBMIT;

b) DELIVER.

A.4 Abbreviated names of OSI-service primitive types

Where necessary to ensure consistency with established use the following abbreviated name forms are used:

a) Request in place of requestor.submit;

b) Indication in place of acceptor.deliver;

c) Response in place of acceptor.submit;

d) Confirm in place of requestor.deliver.

Annex B
Conventions for parameter description

(This annex does not form an integral part of this Recommendation | International Standard)

NOTES

1 This annex provides information for the authors of OSI-service definitions but is not necessary for users of OSI-service definitions.

2 The following conventions should not be taken to imply a preference for tabular approaches; other descriptive techniques may be equally valid.

OSI-service definitions may contain tables describing the parameters associated with each interaction described by an OSI-service primitive. The following notation should be used in these parameter tables:

- M The parameter is mandatory.
- C The parameter is conditional.
- (=) The value of the parameter is semantically identical to the corresponding parameter in the interaction described by the preceding related OSI-service primitive.
- U The use of the parameter is an OSI-service-user option.
- P The use of the parameter is an OSI-service-provider option.
- blank The parameter is not present in the interaction described by the OSI-service primitive concerned.

Annex C
Correlations between OSI-service primitives at different OSI-local views

(This annex does not form an integral part of this Recommendation | International Standard)

NOTE – This annex provides information for the authors of OSI-service definitions but is not necessary for users of OSI-service definitions.

This annex gives three simple examples of the sequencing aspects of the correlations between OSI-service primitives at different OSI-local views. These examples are:

a) *Point-to-point ordered* – This applies to an OSI-service with two interaction points only. A submit primitive at one interaction point causes a subsequent deliver primitive at the other point. The ordering sequence of the deliver primitives at one point is the same as the sequence of the submit primitives at the other point.

b) *Point-to-point unordered* – This is the same as (a) without the ordering constraint.

c) *Point-to-point ordered with expedited flow* – This applies to an OSI-service with two interaction points only. A submit primitive at one point causes a deliver primitive at the other point. OSI-service primitives are classified as either normal-flow or expedited-flow. The ordering sequence of the normal-flow primitives is preserved and the ordering sequence of the expedited-flow primitives is preserved. However, expedited-flow primitives may overtake normal-flow primitives; normal-flow primitives may not overtake expedited-flow primitives.

Further models may be defined as required (e.g. multi-point models).

Annex D
Alternative and additional time-sequence diagrams for two-party communications

(This annex does not form an integral part of this Recommendation | International Standard)

NOTE – This annex provides information for the authors of OSI-service definitions but is not necessary for users of OSI-service definitions.

D.1 The convention in Figure D.1 is used to represent the case in which the OSI-service description does not imply any time relationship between the x-response primitive and the x-confirmation primitive.

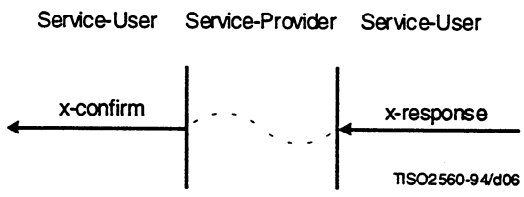


Figure D.1 – Additional convention for time sequence diagrams

D.2 The conventions in Figure D.2 are in use in OSI-service definitions for layers 1-6. While the convention in 7.2.6 represent the passage of time by the angle of the line in the area representing the OSI-service provider, the convention in Figure D.2 represents the passage of time by the angle of the arrows in areas representing the OSI-service users. The convention in Figure D.2 should not be taken as indicating an instantaneous propagation within the OSI-service provider.

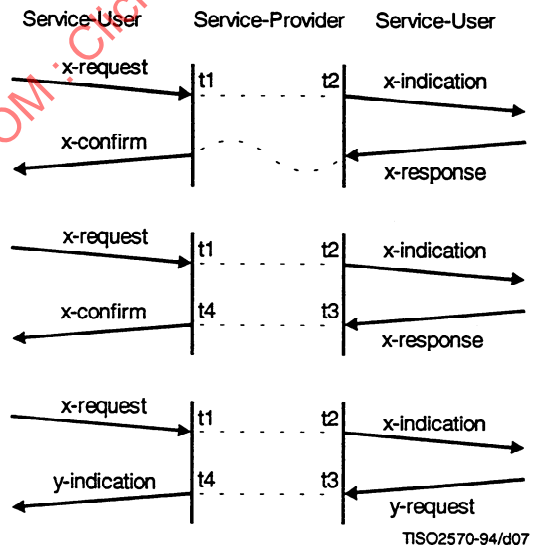


Figure D.2 – Alternative conventions for time sequence diagrams

Annex E
Examples of use of OSI-service definitions

(This annex does not form an integral part of this Recommendation | International Standard)

NOTE – This annex provides information for the authors of OSI-service definitions but is not necessary for users of OSI-service definitions.

E.1 Example of symmetrical service

Session users A and B are equivalent in the sense that the possible states of the respective OSI-local views are the same. At any instant, the state of the two OSI-local views may be different. See Figure E.1

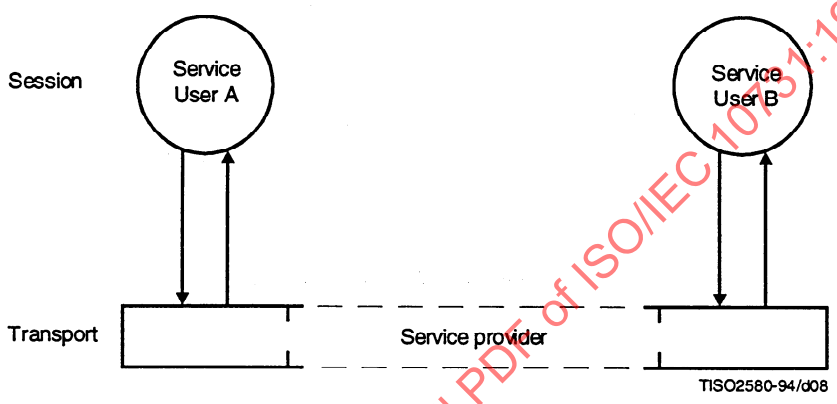


Figure E.1 – Example of a symmetrical service

E.2 Example of asymmetrical service

In this example, only the definition of a client local view includes the issue of a request primitive. See Figure E.2.

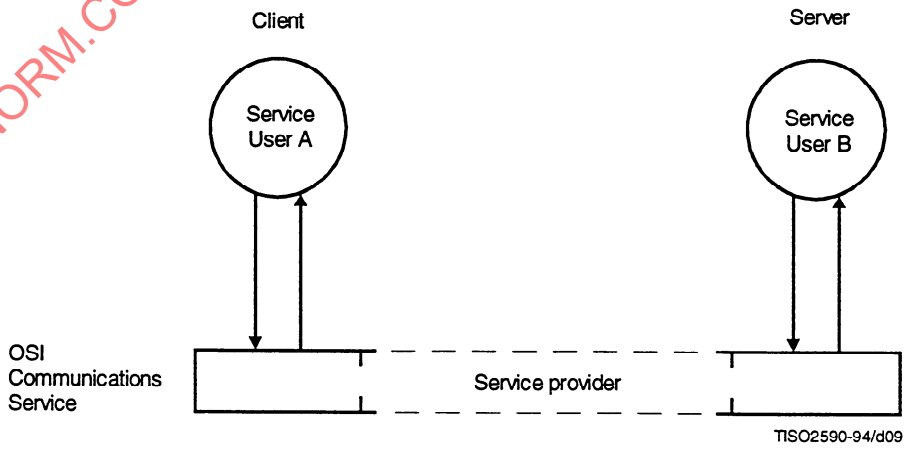


Figure E.2 – Example of an asymmetrical service

Annex F
Abracadabra service definition

(This annex does not form an integral part of this Recommendation | International Standard)

F.1 Introduction

F.1.1 Objective

This OSI-service definition is provided to illustrate the application of the conventions described in this Recommendation | International Standard. The Abracadabra service is one of the example protocols used in the ISO/IEC TR 10167:1991, Information technology – Open Systems Interconnection Guidelines for the application of Estelle, LOTOS and SDL.

F.1.2 Overview of the Abracadabra Service

As described in ISO/IEC TR 10167:1991, the Abracadabra Service operates between a pair of stations, addressed as A and B. Each station is presumed to support a local user interface to the Protocol Entities. The OSI-service offered is a reliable, connection-oriented service between a pair of OSI-service users. OSI-service primitives supported are:

- connection request/indication;
- connection response/confirmation;
- data request/indication;
- disconnect request/indication.

Only the OSI-service primitives for data request and data indication carry a parameter, which is a service-data-unit (SDU). The OSI-service primitives are related as shown in Figure F.1.

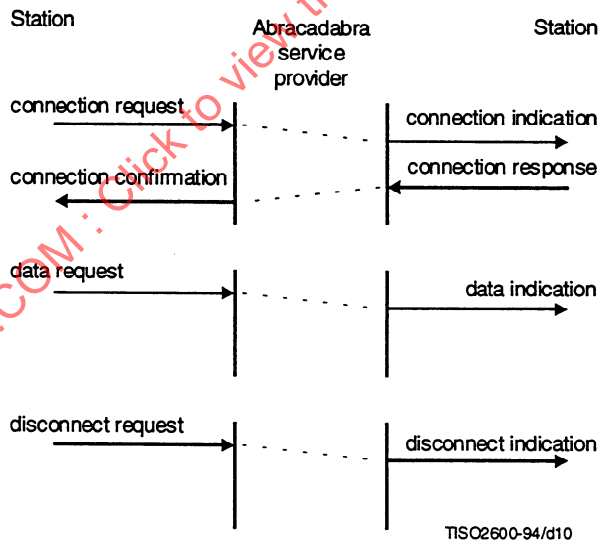


Figure F.1 – Relationship between Abracadabra service primitives

As defined in ISO/IEC TR 10167:1991, the Abracadabra service is symmetrical. To better illustrate the approach, this annex provides two specifications: the protocol as written symmetrically and in a client/server version.

In the first case, it is only necessary to define the behaviour of one OSI-local-view, because the protocol is symmetrical.

In the second case, the OSI-service is defined in terms of a client/server model where the behaviour is asymmetrical. The modification made to achieve this end is to artificially constrain the client to being the only OSI-local view that can initiate or release a connection and to send data. The server is constrained to only accept connections and receive data. In this form, two OSI-local views must be described. It is unlikely that any real protocol would be this completely asymmetrical, but it serves to illustrate the concept.

F.1.3 Symmetrical Service

In the symmetrical service a connection can be established through the OSI-service by either station. The normal sequence of OSI-service primitives is: connection request (at initiating station), connection indication (at the responding station), connection response (at the responding station), connection confirmation (at the initiating station). However, if each station simultaneously initiates a connection then each end sees only connection request, connection confirmation. A connection establishment attempt can also be abandoned by the responding station sending only a disconnect request following connection indication.

Once a connection is established, either station can send a data request which will be delivered as a data indication. Data messages are preserved in sequence and content, except when a disconnection occurs. In this case, an undefined number of data messages already in the OSI-service may be lost. Data transfer is subject to flow control by back-pressure.

Either station may terminate an established connection by issuing disconnect request. This is normally matched by a disconnect indication at the other station, but if the other station issues a disconnect request in the mean time than the connection is terminated immediately.

The OSI-service provider itself can abandon a connection attempt or can terminate the connection. Normally each station which knows of the connection (attempt) is informed of this by disconnect indication. However, if the station issues disconnect request in the mean time then the disconnect indication is not delivered.

Once a connection has been terminated, either party can initiate a new connection with a connection request.

F.1.4 Asymmetrical service

In the asymmetrical service, linking a Client station and a Server station, the establishment and termination of, and the transfer of data on, a connection are controlled by the Client station and, in consequence, connect request and disconnect request collisions cannot occur.

F.1.5 Constraints on OSI-service user and OSI-service provider

As noted in the text of this standard, a OSI-service definition constrains both the OSI-service user and the OSI-service provider. The OSI-service definition defines behaviour that must be incorporated into any complete specification of the behaviour of a OSI-service user or OSI-service provider.

F.2 The States of an OSI-local view

For the purpose of defining the Abracadabra Service, the following states are defined for each OSI-local view.

F.2.1 Null

This is the state of the OSI-local view when there is no connection either being created or currently established.

F.2.2 Connection pending

The OSI-local view enters this state either when the OSI-service user has made a request to establish a connection and is waiting for notification from its peer, or when the OSI-service provider has notified the OSI-service user of an attempted connection and is waiting for notification from the OSI-service user as to the acceptance of the connection.

F.2.3 Data transfer

The OSI-local view enters this state when the connection establishment phase is complete.

F.3 Abracadabra service – Symmetrical version

F.3.1 Connection request and connection response

F.3.1.1 Form

connect.submit()

F.3.1.2 Conditions for invocation by the OSI-service user

When the OSI-local view is in the NULL state, this OSI-service primitive is invoked by the OSI-service user to notify the OSI-service provider of its desire to establish a connection.

When the OSI-local view is in the CONNECTION PENDING state, this OSI-service primitive is invoked by an OSI-service user to notify the OSI-service provider that it is willing to accept the connection.

F.3.1.3 Requirements on the OSI-service provider upon receipt

If the OSI-local view is in the DATA TRANSFER state, then receipt of this OSI-service primitive is an error. The appropriate action is a local matter.

If the OSI-local view is in the NULL state, then receipt of this OSI-service primitive is a request to the OSI-service provider for the establishment of a connection with the OSI-service user at the peer OSI-local view.

The OSI-local view transitions from the NULL to the CONNECTION PENDING state.

If the OSI-local view is in the CONNECTION PENDING state, then receipt of this OSI-service primitive indicates acceptance by the OSI-service user of a request from the OSI-service provider to establish a connection with the OSI-service user at the peer OSI-local view.

The OSI-local view transitions from the CONNECTION PENDING state to the DATA TRANSFER state.

F.3.2 Connection indication and connection confirmation

F.3.2.1 Form

connect.deliver()

F.3.2.2 Conditions for invocation by the OSI-service provider

When the OSI-local view is in the NULL state, then this OSI-service primitive is invoked by the OSI-service provider to notify the OSI-service user that the OSI-service provider has received a request to establish a connection with the OSI-service user at the peer OSI-local view.

The OSI-local view transitions to the CONNECTION PENDING state.

When the OSI-service provider is in the CONNECTION PENDING state, then this OSI-service primitive is invoked by the OSI-service provider to notify the OSI-service user that the OSI-service provider has received a notification that a request for a connection with the OSI-service user at the peer OSI-local view has been accepted.

The OSI-local view transitions to the DATA TRANSFER state.

F.3.2.3 Requirements on the OSI-service user upon receipt

If the OSI-local view is in the NULL state when the OSI-service user receives this OSI-service primitive, then the OSI-service user determines whether or not it wishes to establish the connection (this is a local procedure).

When the OSI-service user wishes to accept the connection, it invokes the connect.submit primitive and the OSI-local view transitions to the DATA TRANSFER state.

When the OSI-service user wishes to refuse the connection, it invokes the disconnect.submit primitive and the OSI-local view remains in the NULL state.