

Telecontrol equipment and systems —

Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations —

Section 501: TASE.1 Service definitions

The European Standard EN 60870-6-501:1996 has the status of a
British Standard

ICS 33.200

National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power systems management and associated information exchange, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
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English version

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Part 6: Telecontrol protocols compatible with ISO standards
and ITU-T recommendations
Section 501: TASE.1 Service definitions
(IEC 870-6-501:1995)

Matériels et systèmes de téléconduite
Partie 6: Protocoles de téléconduite
compatibles avec les normes ISO et
les recommandations de l'UIT-T
Section 501: Définitions des services
TASE.1
(CEI 870-6-501:1995)

Fernwirkrichtungen und -systeme
Teil 6: Fernwirkprotokolle, die mit
ISO-Normen und ITU-T-Empfehlungen
kompatibel sind
Hauptabschnitt 501: Beschreibung
des TASE.1-Dienstes
(IEC 870-6-501:1995)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 57/222/FDIS, future edition 1 of IEC 870-6-501, prepared by IEC TC 57, Power system control and associated communications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60870-6-501 on 1996-03-05.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 1996-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1996-12-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A and B are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 870-6-501:1995 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

The TASE.1 (Telecontrol Application Service Element No. 1) specification has been developed as a result of the TC57 strategy expressed in annex C of the technical report IEC 870-6-1 [1]*. This strategy defines the requirement to standardize only ISO/OSI compliant protocols, and to base the work on proven technology.

The TASE.1 is aimed for use where utilities have a need for exchange of process data, e.g. real-time measurements, breaker status, or energy counter values. The exchange can be on any level within the utility or between utilities using a data network. The network can be local or wide, public or private, but must be able to support standard ISO protocols.

The TASE.1 is an application layer protocol and the corresponding service specifications are based on the ELCOM 90 de facto standard protocol. The services of the proved ELCOM 90 protocol have been moved into a full ISO stack of protocols where standard ISO protocols are used on all levels including layer 7. Some of the services of ELCOM 90 have been mapped directly on the services of the ISO standards ACSE and ROSE while the remaining are included in the TASE.1 services. This solution will ensure a high degree of common software between different communication functions within a system and keep the cost of implementation at a minimum. Please refer to annex C of the technical report IEC 870-6-1 [1]*, for a description of how this TASE.1 fits into the overall architecture.

The TASE.1 protocol will make it possible to exchange data values of different type between telecontrol systems at different levels, for example:

- real-time data values;
- historical data set values;
- supervisory control data values;
- short text messages.

Data transfer can be initiated and controlled in various ways, for example:

- periodic transfer;
- unsolicited transfer, event driven;
- requested transfer.

The data transmission can be done on an individual data item value basis, or data values can be grouped together for more efficient transmission.

The protocol definition is prepared for introduction of new data types. If additional data types are required, these may be defined in an amendment by extension of the ASN.1 syntax of the protocol.

The TASE.1 is designed to operate together with other standard protocols and does therefore not provide functionality already available in other standards in use, for example FTAM for file transfer and X.400 for message transfer.

* Numbers in brackets refer to annex B, Bibliography.

TELECONTROL EQUIPMENT AND SYSTEMS –

Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations – Section 501: TASE.1 Service definitions

1 Scope and object

This section of IEC 870-6 defines the services provided by a telecontrol specific application-service-element – the Telecontrol Application Service Element No. 1 (TASE.1) – for the exchange of process data in telecontrol systems.

The main goals for the design of these services are:

- simplicity;
- adaptability;
- independence of lower layer architecture;
- extensibility;
- efficiency;
- performance;
- maintainability.

The services of TASE.1 are:

- services for defining, changing, deleting and inspecting information groups;
- services for managing the transfer of information groups and blocks of information from different groups;
- services for supervisory control.

The TASE.1 services are provided by the use of the TASE.1 protocol (IEC 870-6-502) in conjunction with the Remote Operations Service Element (ROSE) services (ISO/IEC 9072-1), the ROSE protocol (ISO/IEC 9072-2), and the Association Control Service Element (ACSE) services (ISO 8649) and the ACSE protocol (ISO 8650).

The services defined in this standard allow communication between telecontrol end systems. The primitives comprise a minimum set able to fulfil the following requirements:

- allowing the inclusion of OSI standard protocols for all layers;
- allowing extensions of the services to cope with future OSI requirements.

The services can be applied for the exchange of realtime data, as well as historical and planning data.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 870-6. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 870-6 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 870-6-502: 1995, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO standards and IUT-T recommendations – Section 502: TASE.1 Protocol definitions*

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

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

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

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

ISO 8650: 1988, *Information processing systems – Open Systems Interconnection – Protocol specification for the Association Control Service Element*

ISO 8822: 1994, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824: 1990, *Information technology – Open Systems Interconnection – Specification of the Abstract Syntax Notation One (ASN.1)*

ISO/IEC 9072-1: 1989, *Information processing systems – Text communication – Remote Operations – Part 1: Model notation and service definition*

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

3 Definitions

For the purpose of this section of IEC 870-6, the following definitions apply.

3.1 Reference model definitions (terms defined in ISO 7498)

- a) Application-process
- b) Application-protocol-control-information
- c) Application entity

- d) Application-service-element
- e) Service-element
- f) User-element

3.2 *Naming and addressing definitions* (terms defined in ISO 7498-3)

- a) Application-entity-title
- b) Application-association-identifier

3.3 *Service conventions definitions* (terms defined in ISO/TR 8509)

- a) Service-provider
- b) Service-user
- c) Confirmed service
- d) Non-confirmed service
- e) Provider-initiated service
- f) Primitive
- g) Request
- h) Indication
- i) Response
- j) Confirm

3.4 *Presentation service definition* (term defined in ISO 8822)

- a) Abstract syntax

3.5 *Association control definition* (term defined in ISO 8649)

- a) Application-association; association

3.6 *Remote operations definitions* (terms defined in ISO 9072)

- a) ACSE-user
- b) ROSE-user
- c) BIND
- d) UNBIND

3.7 *TASE.1 definitions*

3.7.1 **analog setpoint group:** Group containing object identifiers for floating-point command values. Analog setpoints are typically used as input parameters for regulators.

3.7.2 **application-association-identifier:** An identifier returned by the ACSE service provider that uniquely identifies a successfully established application association within the TASE.1 environment.

3.7.3 **binary command group:** Group containing object identifiers for two-state (on/off) commands. Binary commands are used to control the state of breakers.

3.7.4 **digital setpoint group:** Group containing object identifiers for two's-complement integer command values. Digital setpoints are typically used as input parameters for regulators.

3.7.5 **discrete group:** Group containing object identifiers for twos-complement integer values. The position of a transformer tap changer is an example for a discrete group.

3.7.6 **logical breaker status group:** Group containing object identifiers for composite three-state status information regarding busbar connection of a feeder and of connections between busbars. Normally the values are calculated locally from the breaker's status values.

3.7.7 **group:** Set of named data objects of same type, implicitly numbered by their indexes.

3.7.8 **group management:** Creating groups, changing groups by means of their group descriptor, and deleting groups.

3.7.9 **group definition:** Unique definition of data objects within one specific group.

3.7.10 **group descriptor:** Set of attributes describing the properties of a group.

3.7.11 **group descriptor attributes:** Parameters describing specific characteristics of a group.

3.7.12 **group incarnation:** Set of simultaneous values from a given group.

3.7.13 **group number:** Unique identifier for one group.

3.7.14 **group type:** Description of the type of objects represented in the group.

3.7.15 **initiator:** TASE.1 service-user that issues the association establishment request service primitive.

3.7.16 **measurand group:** Group containing floating-point values.

3.7.17 **object:** Abstract model of a real device. A specific type and data value is attached to the object. Objects may change their value in course of time. Data objects are named by means of object-identifiers in the local data acquisition environment and by group number and index in the TASE.1 environment.

3.7.18 **object identifier:** Unique object name used in the local data acquisition environment. The object-identifier is used to identify which local data value is to be logically associated with a given combination of group-number and index number.

3.7.19 **responder:** TASE.1 service-user that issues the association establishment response service primitive. A service-user may act as initiator and responder at the same time.

3.7.20 **status group:** Group containing object identifiers for three-state (on/off/between) status values.

3.7.21 **text message group:** Group containing object identifiers for 8-bit character strings.

4 Abbreviations

A-PCI	Application Protocol Control Information
AA	Application Association
ACEP	Application Connection End-Point
ACSE	Association Control Service Element
AE	Application Entity
AS	Application Service
OSI	Open Systems Interconnection
OSIE	Open Systems Interconnection Environment
P-ACEP	ACEP identifier for service-provider
PSAP	Presentation Service Access Point
ROSE	Remote Operations Service Element
SAP	Service Access Point
TASE	Telecontrol Application Service Element
U-ACEP	ACEP identifier for user-element

5 Conventions

5.1 Service parameter description

This section of IEC 870-6 uses the descriptive conventions contained in the OSI service conventions (see ISO/TR 8509). The OSI service conventions define the interaction between service-users and service-providers in the OSI environment. Information is passed between the TASE.1 service-user and the TASE.1 service-provider by service primitives, which may convey parameters.

In accordance with the OSI service conventions, the following notation is used in parameter tables.

M	The parameter is mandatory.
C	The parameter is not always present. Its presence is conditional.
(=)	The value of the parameter is identical to the corresponding parameter in the interaction described by the preceding related service primitive.
U	The use of the parameter is a service-user option.
blank	The parameter is not present in the interaction described by the primitive concerned.

5.2 Initiator and responder

This section of IEC 870-6 makes use of the terms initiator and responder. The initiator is the TASE.1 service-user that issues the TASE Bind request service primitive. The responder is the TASE.1 service-user that issues the TASE Bind response service primitive.

6 Overview of service

The services of TASE.1 are divided into four facilities. Table 1 gives a summary of the facilities and their services. Each facility is explained in the following clauses.

Table 1 – Overview of TASE.1 facilities and services

Name of service	Description of service	Type of service
Association facility		
TASE Bind	Association establishment	Confirmed
TASE Abort	Disruptive association termination	Provider-initiated
TASE Unbind	Association release	Confirmed
Group facility		
Group Management	Create / delete / change group	Confirmed
Define Group	Define objects within a group	Confirmed
Get Group	Read group description	Confirmed
Information transfer facility		
Requested Data Transfer	Request for information	Confirmed
Unsolicited Data Transfer Management	Start/stop of unsolicited data transfer (spontaneous and periodic)	Confirmed
Command Transfer	Send commands and setpoints	Confirmed
Send Confirmed Data	Send information	Confirmed
Send Non-confirmed Data	Send information	Non-confirmed
Send Mixed Data	Send information	Non-Confirmed
Test facility		
Test Association	Test availability and status	Confirmed

6.1 Association facility

The association facility comprises services for association establishment and for orderly and disruptive release of associations.

Association establishment service

The association establishment service enables two service users to establish an association between them.

Simultaneous attempts by both service-users to establish an association between them may result in two associations. This is a matter for the service-users to decide by accepting or rejecting each association. A user of the service-provider may always reject an unwanted association.

No architectural restrictions are placed on the number of concurrent associations.

The association establishment service allows the service-users to exchange parameters describing the association. An established association requires the service users to be in agreement on which set of parameters to use.

The orderly release service

The association orderly release service allows each connected service-user to release the connection. This is done in a cooperative manner between the two service-users without loss of data after all in-transit data have been delivered and accepted by both service-users.

The provider disruptive release service

This service is the means by which the service-provider may indicate the release of the connection by reasons internal to the service-provider or when the underlying service is not available. The service user is responsible for preventing loss of data.

6.2 *Group facility*

This facility enables the service-user to perform group management, group definition and to request group information.

The following services are provided:

- space allocation/deallocation for groups by use of group descriptors;
- update of group descriptor attributes;
- definition of groups by grouping logically independent objects of the same type;
- readout of group definitions.

6.3 *Information transfer facility*

The information transfer facility provides the following services:

- request for data transfer;
- management of unsolicited data transfer (start/stop of spontaneous and periodic data transmission);
- confirmed and non-confirmed data transmission;
- binary command and setpoint data transfer.

6.4 *Test facility*

This facility enables the user to test the reachability and availability of the remote application-process.

7 Model of the service

7.1 TASE.1 service-user and service-provider

The model used conforms to the abstract model for services defined in the OSI service conventions (see ISO/TR 8509) taking into account the specifics of the application layer structure (ISO/IEC 9545) and ROSE. It defines the interactions of application processes (AP), application entities (AE) and application service elements (ASE) with the invocations controlled by the user-element. In this model TASE.1 is ACSE-user and ROSE-user, provides the application-specific mapping of the RO-notation onto the services of ACSE and ROSE, adds additional telecontrol specific syntax and so provides the total telecontrol service to the application-process (AP). In this sense, TASE.1 is service-provider for the AP and the AP is service-user of TASE.1. The service to the AP is provided on the so-termed *operation-interface* using RO-notation. Figure 1 illustrates the relationships between the mentioned elements in the context of the OSI reference model. An AE-invocation may be a partner in a number of application-associations either consecutively or concurrently.

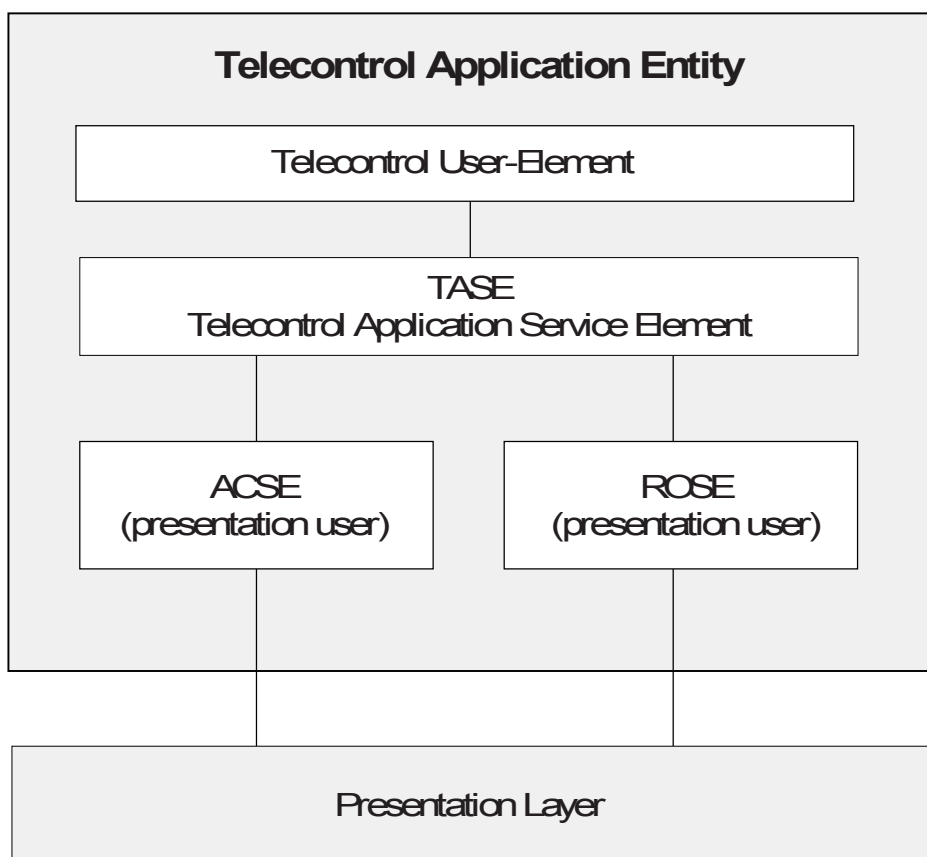


Figure 1 – Model for the TASE.1 application entity in the OSI environment

7.2 Naming and addressing

ISO 7498-3 describes naming and addressing concepts in the OSI environment (OSIE). This subclause describes how some of these concepts apply to TASE.1.

A presentation-address is associated with a set of presentation service access points (PSAPs) in a single real system. An AE is attached to one or more PSAPs in order to make it addressable in the OSIE.

Each AE is identified by one or more application-entity-titles (AE-titles), which are unambiguous throughout the OSIE. At any instance of time, each AE-title is bound to a single presentation-address that identifies the set of PSAPs to which the AE is attached. Information on the binding between an application-entity-title and its presentation addresses shall be contained within the user-element.

An AE must know the presentation-address of another AE in order to establish an application-association with the AE. The presentation-address to be used by establishment shall be passed transparently from the TASE.1 user-element to the association control service element (ACSE) within the TASE.1 AE.

In order for an AE to check that the required AE is still attached to the PSAP identified by the presentation-address, the initiating AE-invocation shall pass the called-application-entity-title as part of the application-protocol-control-information (A-PCI) exchanged to establish the application-association.

An application association may be associated with an application-association-identifier. The application-association-identifier is unambiguous within the scope of the pair of associated application-entity-invocations. This allows the service-user and the service-provider to distinguish between several connections at the same service-access-point and provides the means to identify the related state information in each application-entity-invocation.

Application-association-identifiers may be exchanged as part of the A-PCI when establishing an association.

7.3 Group modelling

This section of IEC 870-6 makes use of the term "group" to describe the TASE.1 services. Single objects, which are abstract models of real devices, are assigned to groups.

A group is characterized by a number of attributes, which serve to describe some features of all objects of this group. Each instance of a group has the same set of attribute values, common to all objects in the group.

A group is a bilateral definition of a set of named objects, uniquely identified by a group number and the application-entity-title of the partner end-system. Objects are named unambiguously to reference data objects within the two communicating end-systems. When an object is assigned to a group, the object can be identified by means of its index number within the group. Similarly, ranges of objects can be identified by means of their starting and ending indexes.

In TASE, groups are syntactically defined as sets of objects with common attributes:

- group: (group number (value))
 - attribute: (group type (value))
 - attribute: (persistent (value))
 - attribute: (static (value))
 - attribute: (priority (value))
 - attribute: (group size (value))
 - attribute: (object identifier length (value))
- object set:
 - object 1:
 - attribute: (object index number (value))
 - attribute: (object name (value))
 - object 2:
 - attribute: (object index number (value))
 - attribute: (object name (value))

8 Sequences of service primitives

8.1 Overview of service relationships

This subclause defines the interrelationships among the services and functional facilities of the application layer. These relationships are illustrated in figure 2.

TASE Bind shall be performed before the other service elements can be performed.

Note that the *TASE Abort* service can occur at any time after the application association has been established. The *TASE Abort* service procedure disrupts all other services. The association will then be terminated.

Facilities	Service
Association (establishment)	TASE Bind
Group	Group Management
Information Transfer	Define Group
	Get Group
	Unsolicited Data Transfer Management (Start)
	Send Confirmed Data
	Send Non-confirmed Data
	Send Mixed Data
	Unsolicited Data Transfer
	Requested Data Transfer
	Command Transfer
Test	Test Association
Association (release)	TASE Unbind
	TASE Abort

Figure 2 – Application layer functional facilities and related services

8.2 Sequences

Each of the following time-sequence diagrams is partitioned by two vertical lines into three fields. The central field represents the service-provider. The two side fields represent the two service-users.

Sequences of primitives are positioned along lines representing the passage of time, increasing downwards.

Arrows, placed in the areas representing the service-user, indicate the direction of propagation of primitives.

Necessary sequence relations between peer service-users are controlled by user conventions. Dashed lines in the time sequence diagram emphasize an example of a necessary convention to control the sequence relations to realize the management of unsolicited data transfer.

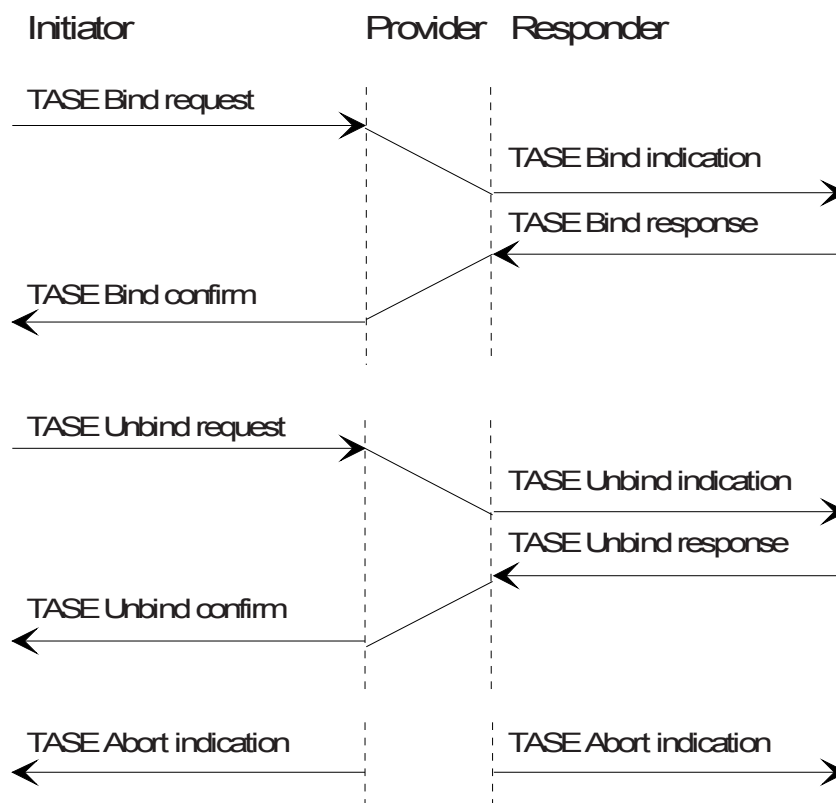


Figure 3 – Association establishment and termination time-sequence diagram

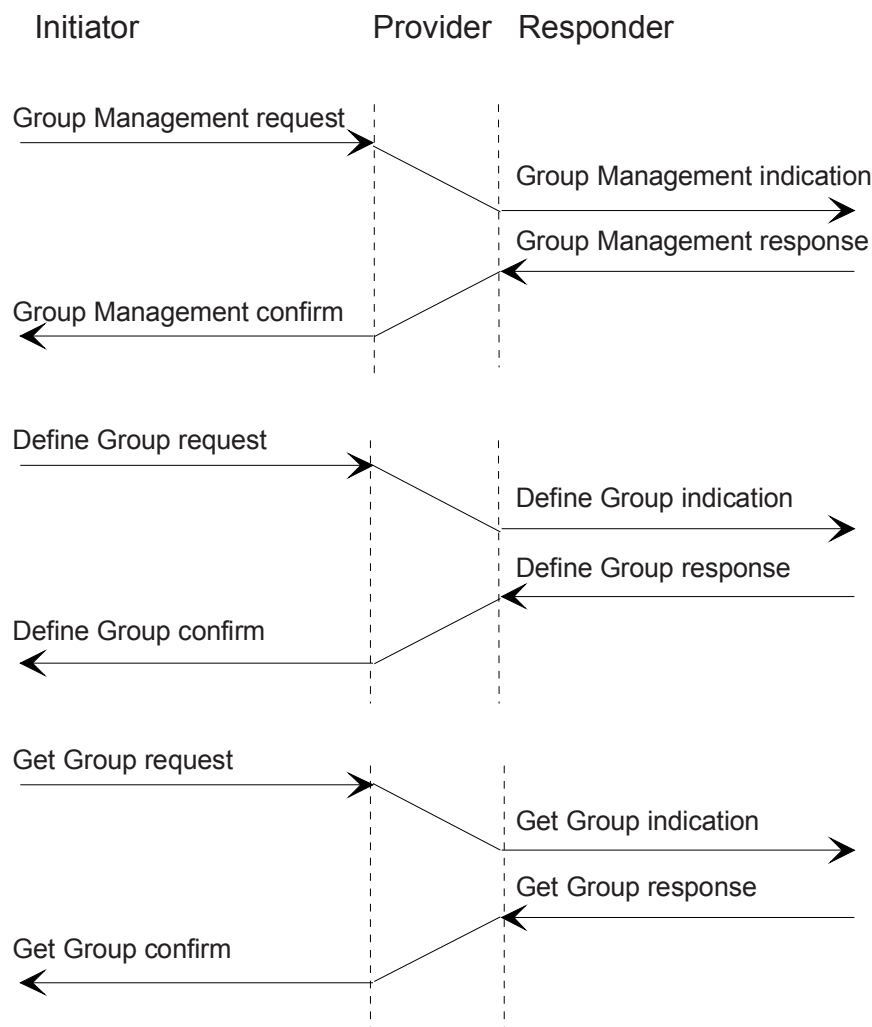


Figure 4 - Group configuration time-sequence diagram

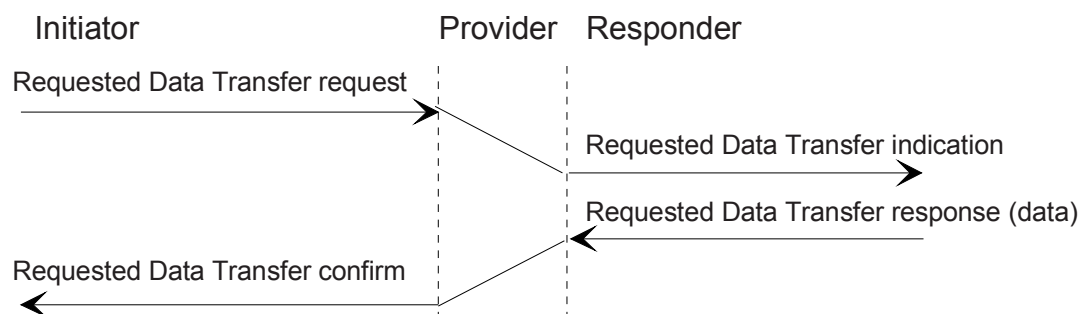
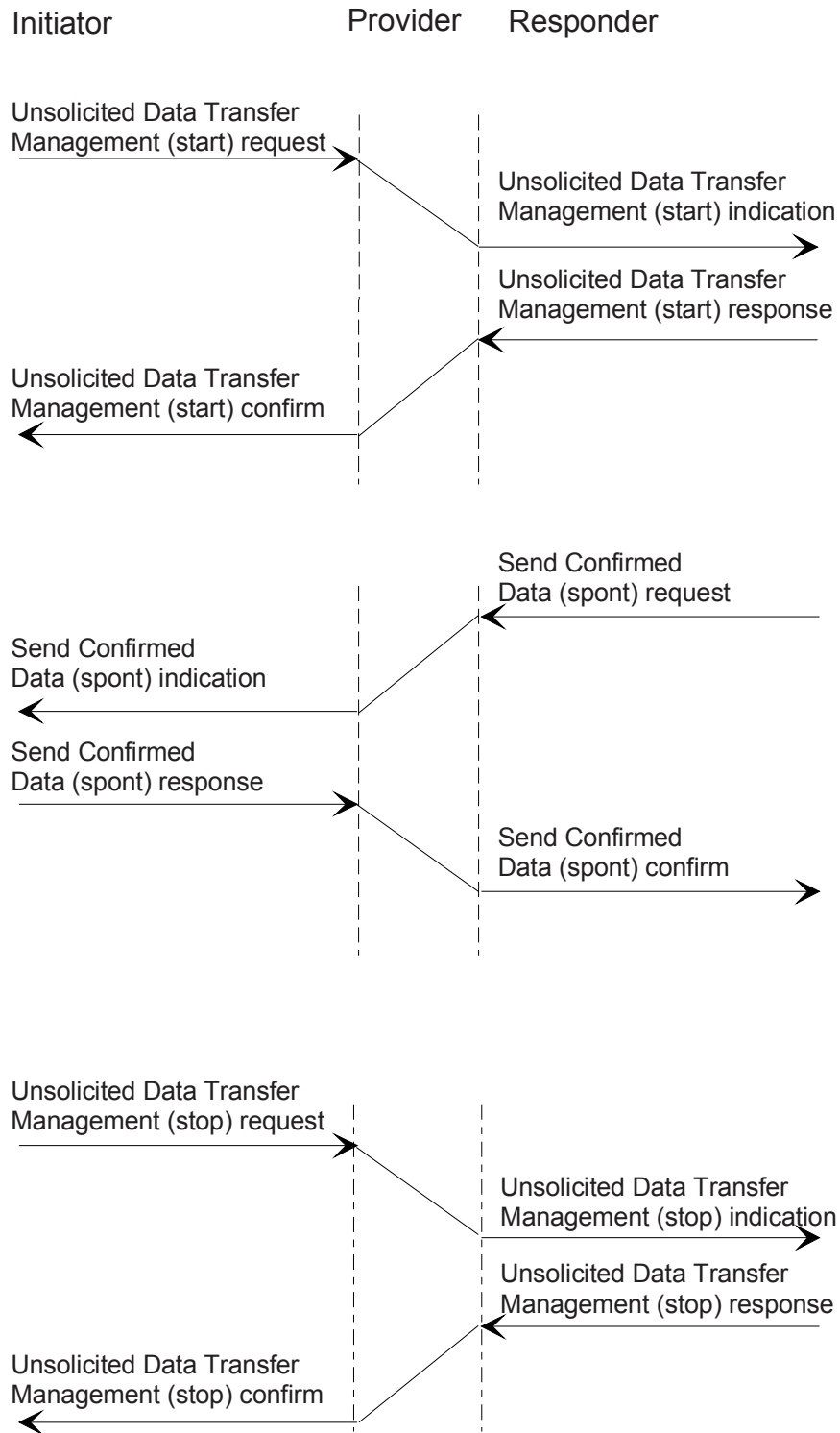
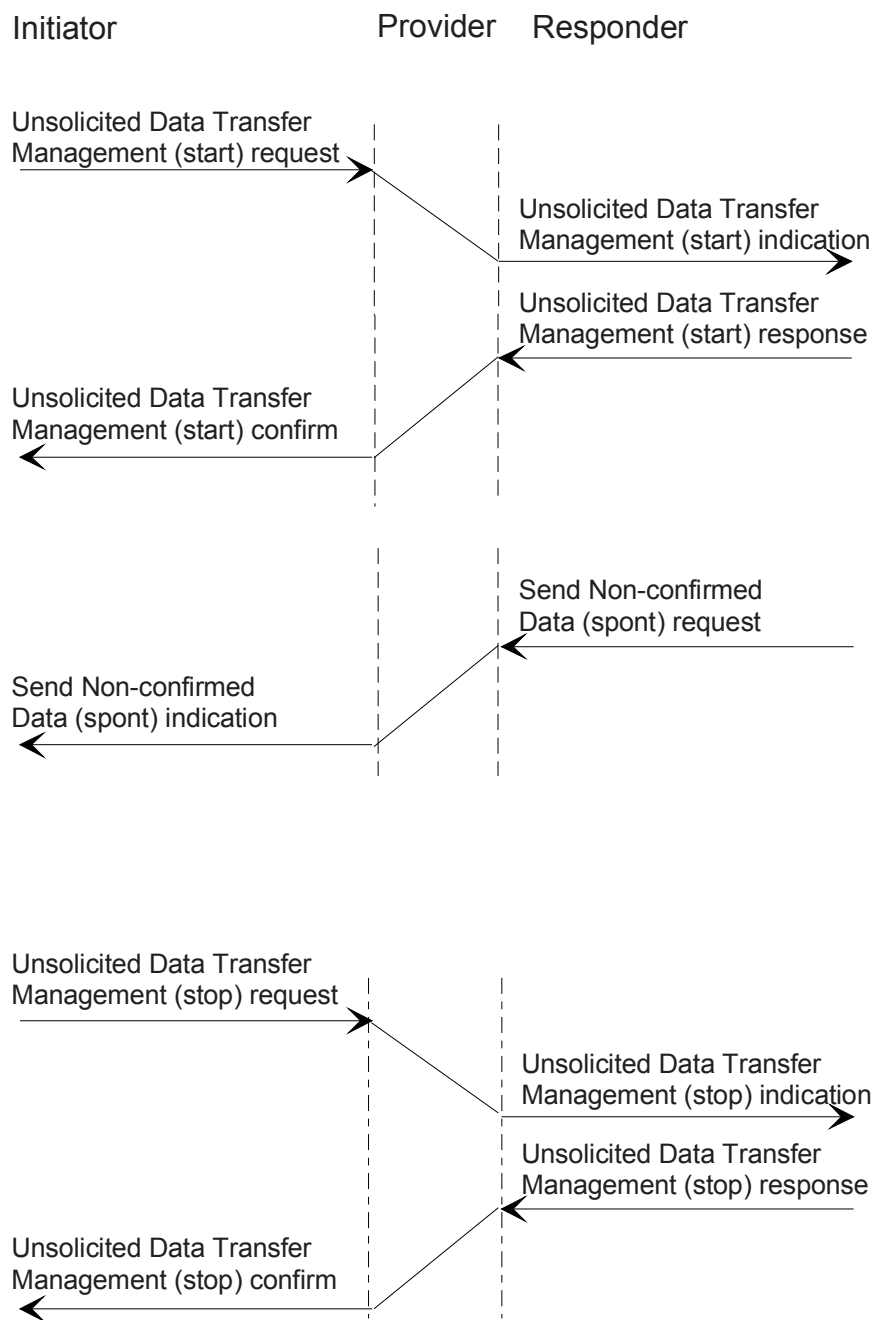


Figure 5 - Requested Data Transfer time-sequence diagram



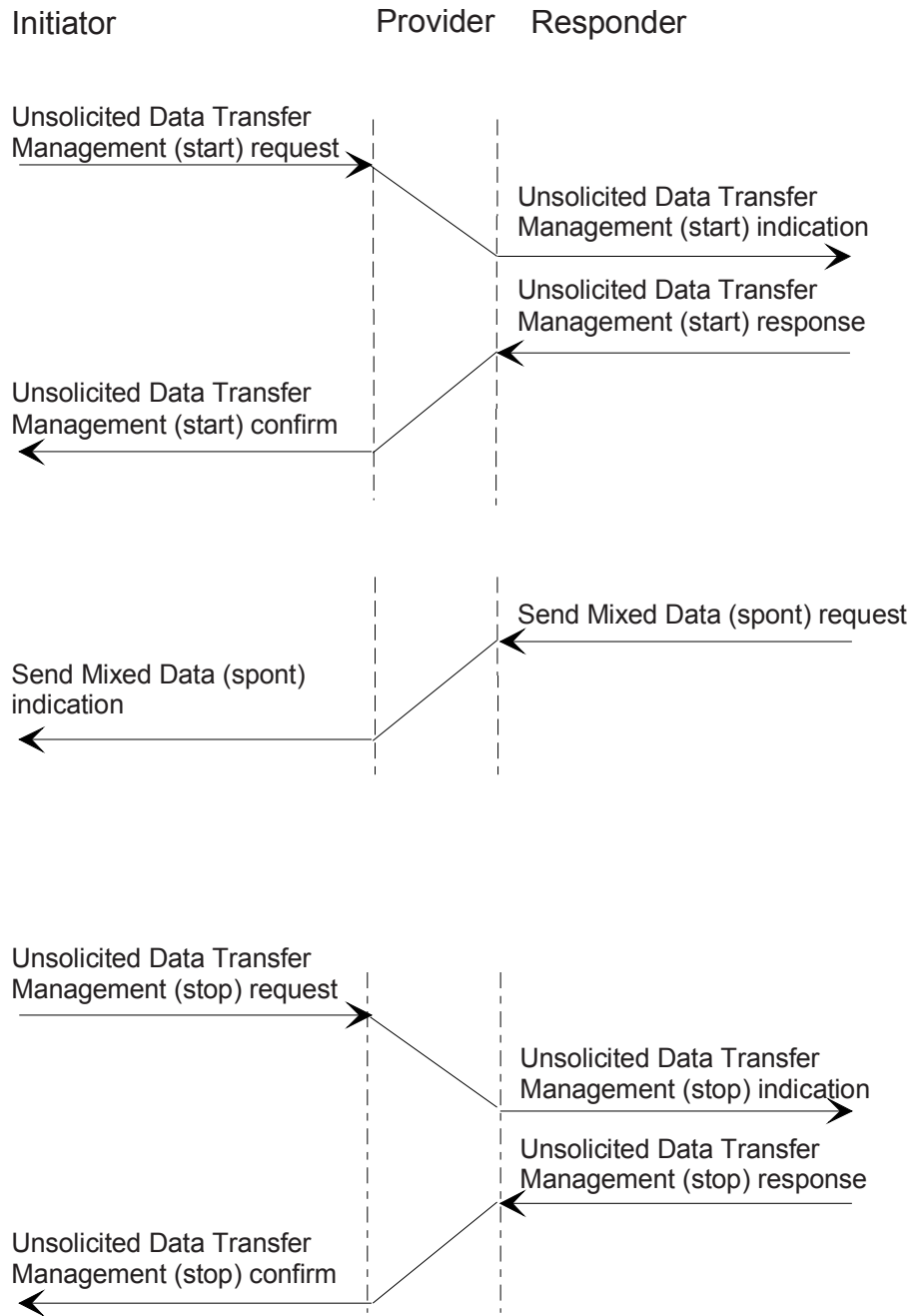
NOTE - The Send Confirmed Data service may be issued several times before the initiator performs an Unsolicited Data Transfer Management (stop).

Figure 6 - Unsolicited Data Transfer, spontaneous data with confirmation, time-sequence diagram



NOTE - The Send Non-confirmed Data service may be issued several times before the initiator performs an Unsolicited Data Transfer Management (stop).

Figure 7 - Unsolicited Data Transfer, spontaneous data without confirmation, time-sequence diagram



NOTE - The Send Mixed Data service may be issued several times before the initiator performs an Unsolicited Data Transfer Management (stop).

Figure 8 - Unsolicited Data Transfer, mixed data (spontaneous) time-sequence diagram

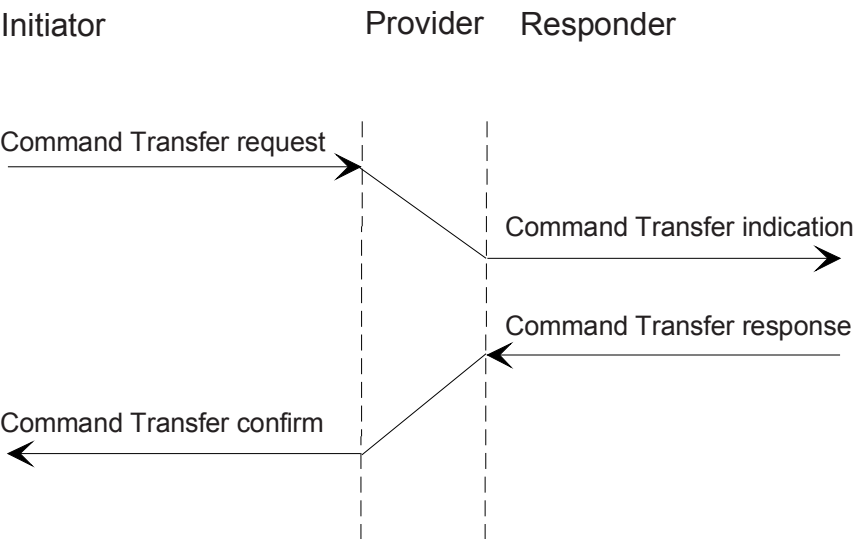


Figure 9 - Command transfer time-sequence diagram

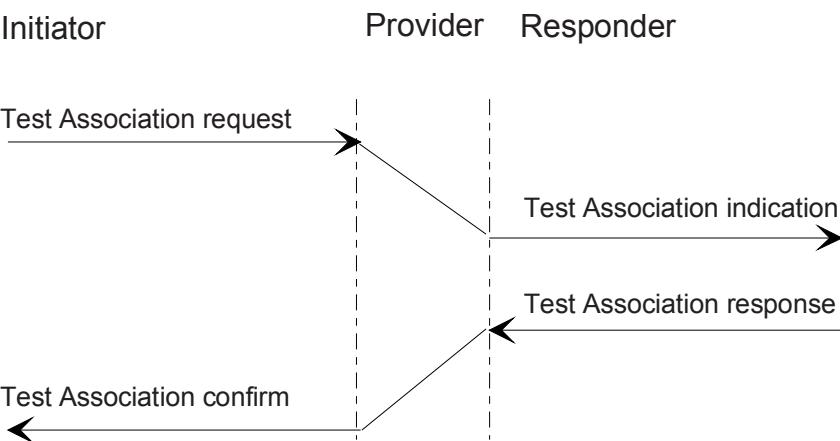


Figure 10 - Test association time-sequence diagram

9 Service definition

Refer to table 1 for a complete list of the TASE.1 services.

9.1 TASE Bind service

The TASE Bind service allows two users to establish an association between them.

The service allows information interchange between the service-users.

9.1.1 TASE Bind parameters

The structure of the component service primitives is shown in table 2.

Table 2 – TASE Bind parameters

Parameter name	Request	Indication	Response	Confirm
Security-option	U	(=)	U	(=)
Authentication-value	U	(=)	U	(=)
Restart-marking			U	(=)
Consistency			U	(=)
Result			M	M

9.1.1.1 Security-option

This parameter indicates the security options requested for the association.

9.1.1.2 Authentication-value

This parameter holds the Authentication value.

9.1.1.3 Restart-marking

This parameter defines whether restart of group configuration and/or unsolicited transfer management is necessary for the established connection.

9.1.1.4 Consistency

The Consistency parameter is used for checking group configuration consistency.

9.1.1.5 Result

The Result parameter specifies the status of the service call:

- ok;
- local lack of resources;
- remote lack of resources;
- no answer from remote system;

- remote service-user unavailable;
- called user unknown;
- misbehaviour of local service-user;
- misbehaviour of remote service-user;
- misbehaviour of local part of provider;
- misbehaviour of remote part of provider;
- incompatible versions;
- no available lower level connection;
- security is not supported by service-user;
- incompatible security options requested;
- authentication failure;
- system implementation dependent reason;
- unknown reason.

9.1.2 Service procedure

The responding TASE.1-user shall issue a response primitive indicating success with the Result parameter set to ok if that TASE.1-user is willing to accept communications in the TASE.1 environment under the constraints identified in the indication primitive. Otherwise, the TASE.1-user shall issue a response primitive indicating the reason for rejection in the Result parameter.

Successful execution of the TASE Bind service shall result in the establishment of the TASE.1 environment. The TASE.1 environment shall only be established through the use of the TASE Bind service. The TASE Bind service shall not be used within the TASE.1 environment.

9.2 TASE Unbind service

The TASE Unbind service is used by the service-user to (orderly) release an association with no loss of previously issued data.

9.2.1 TASE Unbind parameters

The structure of the component service primitives is shown in table 3.

Table 3 – TASE Unbind parameters

Parameter name	Request	Indication	Response	Confirm
User-reason	M	(=)		
Result			M	(=)

9.2.1.1 User-reason

The User-reason parameter specifies the user's reason for initiating an association release. The parameter can have one of the following values:

- orderly termination;
- invalid authentication code received;
- decipherment error.

9.2.1.2 Result

The Result parameter specifies the status of the service:

- ok;
- collision.

9.2.2 Service procedure

The requesting TASE.1-user shall issue a TASE Unbind request primitive, which invokes the TASE Unbind service. Once this primitive has been issued, the requesting TASE.1-user shall not issue any further request primitives until a TASE Unbind confirm primitive is received from the TASE.1 service-provider. The requesting TASE.1-user may continue to issue response primitives in order to complete service requests from the peer TASE.1-user.

Upon receiving a TASE Unbind confirm primitive without negative result the service is completed and the communications in the TASE environment ends. Upon receiving a TASE Unbind confirm primitive with negative result, the requesting TASE.1-user shall consider the TASE.1 environment to be unaffected, and may continue to issue request or response primitives in the TASE.1 environment.

NOTE – It is possible that both peer service-users will issue a TASE Unbind attempt at or near the same time resulting in failure (Result parameter set to collision) of both attempts.

9.3 TASE Abort service

The TASE Abort service is used by the service-provider to inform the user of abnormal termination of an association.

9.3.1 TASE Abort parameters

The structure of the component service primitives is shown in table 4.

Table 4 – TASE Abort parameters

Parameter name	Request	Indication	Response	Confirm
Reason		M		

9.3.1.1 Reason

The reason parameter specifies the reason for the termination of the association, and can take one of the following values:

- quality of service below minimum level;