
**Information technology — Open Systems
Interconnection — The Directory: Protocol
specifications**

*Technologies de l'information — Interconnexion de systèmes ouverts
(OSI) — L'annuaire: Spécification du protocole*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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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.

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

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 9594 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Users and implementors should note the existence of a "defect resolution" procedure in ISO/IEC JTC 1 to identify and correct errors in International Standards through the publication of Technical Corrigenda. Identical corrections are made to the corresponding ITU-T Recommendations through Corrigenda and may also be made in the form of Implementors' Guides. Details of Technical Corrigenda to International Standards are available on the ISO website; published Technical Corrigenda can be obtained via the ISO webstore or from the ISO and IEC national bodies. Corrigenda and Implementors' Guides to ITU-T Recommendations can be obtained from the ITU-T website.

[ISO/IEC 9594-5:2001](http://www.iso.org/iso/iec/9594-5:2001)

ISO/IEC 9594-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*, in collaboration with ITU-T. The identical text is published as ITU-T Rec. X.519.

This fourth edition of ISO/IEC 9594-5 constitutes a technical revision of the third edition (ISO/IEC 9594-5:1998), which is provisionally retained in order to support implementations based on the third edition. This edition also incorporates Corrigendum 1:2002.

ISO/IEC 9594 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — The Directory*:

- *Part 1: Overview of concepts, models and services*
- *Part 2: Models*
- *Part 3: Abstract service definition*
- *Part 4: Procedures for distributed operation*
- *Part 5: Protocol specifications*
- *Part 6: Selected attribute types*
- *Part 7: Selected object classes*
- *Part 8: Public-key and attribute certificate frameworks*
- *Part 9: Replication*
- *Part 10: Use of systems management for administration of the Directory*

Annexes A to H form a normative part of this part of ISO/IEC 9594. Annex I is for information only.

Introduction

This Recommendation | International Standard, together with the other Recommendations | International Standards, has been produced to facilitate the interconnection of information processing systems to provide directory services. A set of such systems, together with the directory information that they hold, can be viewed as an integrated whole, called the *Directory*. The information held by the Directory, collectively known as the Directory Information Base (DIB), is typically used to facilitate communication between, with or about objects such as application entities, people, terminals and distribution lists.

The Directory plays a significant role in Open Systems Interconnection, whose aim is to allow, with a minimum of technical agreement outside of the interconnection standards themselves, the interconnection of information processing systems:

- from different manufacturers;
- under different managements;
- of different levels of complexity; and
- of different ages.

This Recommendation | International Standard specifies the application service elements and application contexts for two protocols – the Directory Access Protocol (DAP) and the Directory System Protocol (DSP). The DAP provides for access to the Directory to retrieve or modify Directory information. The DSP provides for the chaining of requests to retrieve or modify Directory information to other parts of the distributed Directory System where the information may be held.

In addition this Recommendation | International Standard specifies the application service elements and application contexts for the Directory Information Shadowing Protocol (DISP) and the Directory Operational Binding Management Protocol (DOP). The DISP provides for the shadowing of information held in one DSA to another DSA. The DOP provides for the establishment, modification and termination of bindings between pairs of DSAs for the administration of relationships between the DSAs (such as for shadowing or hierarchical relationships).

This fourth edition technically revises and enhances, but does not replace, the third edition of this Recommendation | International Standard. Implementations may still claim conformance to the third edition. However, at some point, the third edition will not be supported (i.e. reported defects will no longer be resolved). It is recommended that implementations conform to this fourth edition as soon as possible.

This fourth edition specifies version 1 and version 2 of the Directory protocols.

The first and second editions specified only version 1. Most of the services and protocols specified in this edition are designed to function under version 1. However some enhanced services and protocols, e.g. signed errors, will not function unless all Directory entities involved in the operation have negotiated version 2. Whichever version has been negotiated, differences between the services and between the protocols defined in the four editions, except for those specifically assigned to version 2, are accommodated using the rules of extensibility defined in this edition of ITU-T Rec. X.519 | ISO/IEC 9594-5.

This Directory Specification also specifies an alternative version of the DAP, DSP, DISP and DOP protocols, known as DAP-IP, DSP-IP, DISP-IP and DOP-IP respectively, which are mappings of the corresponding abstract services directly onto the TCP/IP protocol instead of onto an OSI stack. These alternative protocols allow support of Directory service elements without the implementation overhead of supporting a full OSI stack.

Annex A, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the directory access protocol.

Annex B, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the directory system protocol.

Annex C, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the directory information shadowing protocol.

Annex D, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the directory operational binding management protocol.

Annex E, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the IDM protocol specification.

Annex F, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the Directory IDM protocols.

Annex G, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module which contains all the ASN.1 object identifiers assigned in this Recommendation | International Standard.

Annex H, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module which contains all the ASN.1 object identifiers assigned to identify operational binding types in this series of Recommendations | International Standards.

Annex I, which is not an integral part of this Recommendation | International Standard, lists the amendments and defect reports that have been incorporated to form this edition of this Recommendation | International Standard.

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

Information technology – Open Systems Interconnection – The Directory: Protocol specifications

1 Scope

This Recommendation | International Standard specifies the Directory Access Protocol, the Directory System Protocol, the Directory Information Shadowing Protocol, and the Directory Operational Binding Management Protocol fulfilling the abstract services specified in ITU-T Rec. X.511 | ISO/IEC 9594-3, ITU-T Rec. X.518 | ISO/IEC 9594-4, and ITU-T Rec. X.525 | ISO/IEC 9594-9.

2 Normative references

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

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*.
- ITU-T Recommendation X.213 (1995) | ISO/IEC 8348:1996, *Information technology – Open Systems Interconnection – Network service definition*.
- ITU-T Recommendation X.214 (1995) | ISO/IEC 8072:1996, *Information technology – Open Systems Interconnection – Transport service definition*.
- ITU-T Recommendation X.215 (1995) | ISO/IEC 8326:1996, *Information technology – Open Systems Interconnection – Session service definition*.
- ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition*.
- ITU-T Recommendation X.217 (1995) | ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the Association Control Service Element*.
- ITU-T Recommendation X.227 (1995) | ISO/IEC 8650-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented protocol for the Association Control Service Element: Protocol specification*.
- ITU-T Recommendation X.500 (2001) | ISO/IEC 9594-1:2001, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services*.
- ITU-T Recommendation X.501 (2001) | ISO/IEC 9594-2:2001, *Information technology – Open Systems Interconnection – The Directory: Models*.
- ITU-T Recommendation X.509 (2000) | ISO/IEC 9594-8:2001, *Information technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks*.
- ITU-T Recommendation X.511 (2001) | ISO/IEC 9594-3:2001, *Information technology – Open Systems Interconnection – The Directory: Abstract service definition*.

ISO/IEC 9594-5:2001 (E)

- ITU-T Recommendation X.518 (2001) | ISO/IEC 9594-4:2001, *Information technology – Open Systems Interconnection – The Directory: Procedures for distributed operation.*
- ITU-T Recommendation X.520 (2001) | ISO/IEC 9594-6:2001, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types.*
- ITU-T Recommendation X.521 (2001) | ISO/IEC 9594-7:2001, *Information technology – Open Systems Interconnection – The Directory: Selected object classes.*
- ITU-T Recommendation X.525 (2001) | ISO/IEC 9594-9:2001, *Information technology – Open Systems Interconnection – The Directory: Replication.*
- ITU-T Recommendation X.530 (2001) | ISO/IEC 9594-10:1998, *Information technology – Open Systems Interconnection – The Directory: Use of systems management for administration of the Directory.*
- ITU-T Recommendation X.680 (1997) | ISO/IEC 8824-1:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*
- ITU-T Recommendation X.681 (1997) | ISO/IEC 8824-2:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*
- ITU-T Recommendation X.682 (1997) | ISO/IEC 8824-3:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*
- ITU-T Recommendation X.683 (1997) | ISO/IEC 8824-4:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.*
- ITU-T Recommendation X.690 (1997) | ISO/IEC 8825-1:1998, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).*
- ITU-T Recommendation X.880 (1994) | ISO/IEC 13712-1:1995, *Information technology – Remote Operations: Concepts, model and notation plus Technical Corrigendum 1 (1995).*
- ITU-T Recommendation X.880 (1994)/Amd.1 (1995) | ISO/IEC 13712-1:1995/Amd.1:1996, *Information technology – Remote Operations: Concepts, model and notation – Amendment 1: Built-in operations.*
- ITU-T Recommendation X.881 (1994) | ISO/IEC 13712-2:1995, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) service definition.*
- ITU-T Recommendation X.881 (1994)/Amd.1 (1995) | ISO/IEC 13712-2:1995/Amd.1:1996, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) service definition – Amendment 1: Mapping to A-UNIT-DATA and built-in operations.*
- ITU-T Recommendation X.882 (1994) | ISO/IEC 13712-3:1995, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) protocol specification plus Technical Corrigendum 1 (1995).*
- ITU-T Recommendation X.882 (1994)/Amd.1 (1995) | ISO/IEC 13712-3:1995/Amd.1:1996, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) protocol specification – Amendment 1: Mapping to A-UNIT-DATA and built-in operations.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- ITU-T Recommendation X.218 (1993) *Reliable Transfer: Model and Service Definition.*
ISO/IEC 9066-1:1989, *Information processing systems – Text communication – Reliable Transfer – Part 1: Model and service definition.*

2.3 ISO/IEC Standards

- ISO/IEC 10646-1:2000, *Information technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1 – Architecture and Basic Multilingual Plane.*

2.4 Other references

- ITU-T Recommendation E.164 (1997), *The international public telecommunication numbering plan.*
- ITU-T Recommendation X.121 (2000), *International numbering plan for public data networks.*
- IETF RFC 2025 (1996), *The Simple Public-Key GSS-API Mechanism (SPKM).*

- IETF RFC 793 (1981), *Transmission control protocol – DARPA Internet Program – Protocol Specification*.
- IETF RFC 1277 (1991), *Encoding Network Addresses to support operation over non-OSI lower layers*.
- IETF RFC 1738 (1994), *Uniform Resource Locators (URL)*.

3 Definitions

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

3.1 OSI Reference Model Definitions

The following terms are defined in ITU-T Rec. X.200 | ISO/IEC 7498-1:

- a) *abstract-syntax*;
- b) *application-context*;
- c) *application-entity*;
- d) *application process*;
- e) *application-protocol-control-information*;
- f) *application-protocol-data-unit*;
- g) *application-service-element*.

3.2 Remote Operations Definitions

The following terms are defined in ITU-T Rec. X.880 | ISO/IEC 13712-1:

- a) *connection package*;
- b) *contract, association contract*;
- c) *error*;
- d) *operation*; <https://standards.iteh.ai/catalog/standards/sist/da85b0fe-7aac-401d-b982-affbfc76210/iso-iec-9594-5-2001>
- e) *operation package*;
- f) *ROS-object*.

3.3 Basic Directory Definitions

The following terms are defined in ITU-T Rec. X.501 | ISO/IEC 9594-2:

- a) *the Directory*;
- b) *(Directory) user*;
- c) *Directory System Agent (DSA)*;
- d) *Directory User Agent (DUA)*.

3.4 Distributed Operation Definitions

The following terms are defined in ITU-T Rec. X.518 | ISO/IEC 9594-4:

- a) *chaining*;
- b) *referral*.

3.5 Upper layer security definitions

The following terms are used as defined in ITU-T Rec. X.803 | ISO/IEC 10745:

- a) *security association*;
- b) *security transformation*;
- c) *security exchange*;
- d) *security exchange item*.

The following terms are used as defined in ITU-T Rec. X.830 | ISO/IEC 11586-1:

- a) *protecting transfer syntax*;
- b) *protection mapping*.

4 Abbreviations

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

AC	Application Context
ACSE	Association Control Service Element
AE	Application Entity
APCI	Application Protocol Control Information
APDU	Application Protocol Data Unit
ASE	Application Service Element
DAP	Directory Access Protocol
DISP	Directory Information Shadowing Protocol
DOP	Directory Operational Binding Management Protocol
DSA	Directory System Agent
DSP	Directory System Protocol
DUA	Directory User Agent
GULS	Generic Upper Layers Security
ROS	Remote Operations Service
ROSE	Remote Operations Service Element
RTSE	Reliable Transfer Service Element

5 Conventions

With minor exceptions this Directory Specification has been prepared according to the "Rules for presentation of ITU-T | ISO/IEC common text" in the Guide for ITU-T and ISO/IEC JTC 1 Cooperation, October 1996.

The term "Directory Specification" (as in "this Directory Specification") shall be taken to mean ITU-T Rec. X.519 | ISO/IEC 9594-5. The term "Directory Specifications" shall be taken to mean the X.500-series Recommendations and all parts of ISO/IEC 9594.

This Directory Specification uses the term "1988 edition systems" to refer to systems conforming to the first edition of the Directory Specifications, i.e. the 1988 edition of the series of CCITT X.500 Recommendations and the ISO/IEC 9594:1990 edition. This Directory Specification uses the term "1993 edition systems" to refer to systems conforming to the second (1993) edition of the Directory Specifications, i.e. the 1993 edition of the series of ITU-T X.500 Recommendations and the ISO/IEC 9594:1995 edition. This Directory Specification uses the term "1997 edition systems" to refer to systems conforming to the third edition of the Directory Specifications, i.e. the 1997 edition of the series of ITU-T X.500 Recommendations and the ISO/IEC 9594:1998 edition. This Directory Specification uses the term "4th edition systems" to refer to systems conforming to this fourth edition of the Directory Specifications, i.e. the 2001 editions of ITU-T X.500, X.501, X.511, X.518, X.519, X.520, X.521, X.525, and X.530, the 2000 edition of ITU-T X.509, and parts 1-0 of the ISO/IEC 9594:2001 edition.

This Directory Specification presents ASN.1 notation in the bold Helvetica typeface. When ASN.1 types and values are referenced in normal text, they are differentiated from normal text by presenting them in the bold Helvetica typeface. The names of procedures, typically referenced when specifying the semantics of processing, are differentiated from normal text by displaying them in bold Times. Access control permissions are presented in italicized Times.

If the items in a list are numbered (as opposed to using "-" or letters), then the items shall be considered steps in a procedure.

This Directory Specification defines directory operations using the Remote Operation notation defined in ITU-T Rec. X.880 | ISO/IEC 13712-1.

6 OSI protocol overview

6.1 Remote Operations – Specification and OSI Realization

ITU-T Rec. X.880 | ISO/IEC 13712-1 defines several information object classes that are useful in the specification of ROS-based application protocols such as the various Directory protocols defined in this Directory Specification. A number of these classes are used in this and subsequent clauses. The specification techniques provided in ITU-T Rec. X.880 | ISO/IEC 13712-1 are used to define a generic protocol between objects. When realized as an OSI application layer protocol, the concepts of ITU-T Rec. X.880 | ISO/IEC 13712-1 are mapped to OSI concepts in ITU-T Rec. X.881 | ISO/IEC 13712-2 and ITU-T Rec. X.882 | ISO/IEC 13712-3.

The **ROS-OBJECT-CLASS** class is used to define a set of common capabilities of a set of ROS-objects in terms of the (association) contracts they support as initiators and/or responders. When realized using the communication services of OSI, a ROS-object maps to an application process and a contract to an application context. In these Directory Specifications the term abstract service is used to refer to a ROS association contract and OSI application layer protocol to refer to the realization of a contract between two open systems using OSI communication services.

The **OPERATION-PACKAGE** class is used to define a set of operations which may be invoked by a ROS-object assuming the role of "consumer", the operations which may be invoked by a ROS-object assuming the role of "supplier", and the operations which may be invoked by both ROS-objects. When using the communication services of OSI, an operation package is realized as an application service element (ASE).

The **CONNECTION-PACKAGE** class is used to define the bind and unbind operations used to establish and release an association. When realized using the communication services of OSI, a connection package is realized as the procedures that use the services of the Association Control Service Element.

The **CONTRACT** class is used to define an association contract in terms of a connection package and one or more operation packages. When specifying the contract, the packages in which the association initiator assumes the role of consumer, the association responder assumes the role of consumer, and either may assume the role of consumer are identified. When using the communication services of OSI, a contract is realized as an application context.

The **APPLICATION-CONTEXT** class is used to define the static aspects of an application context. These include the contract that is realized via the application context, the OSI service that establishes and releases the association, the OSI service that provides information transfer for the interactions of the contract, and the abstract syntaxes used.

The **ABSTRACT-SYNTAX** class, which is built in to ASN.1, is used to define and assign an object identifier to an ASN.1 type whose values comprise an abstract syntax.

The OSI application layer protocols defined in the Directory Specifications, the DAP, DSP, DISP and DOP, are protocols to provide communication between a pair of application processes. In the OSI environment this is represented as communication between a pair of Application-Entities (AEs) using the presentation service. The function of an AE is provided by a set of Application-Service-Elements (ASEs). The interaction between AEs is described in terms of their use of the services provided by the ASEs. All the services provided by the Directory ASEs are contained in a single AE.

The Remote Operations Service Element (ROSE) supports the request/reply paradigm of the operation. The Directory ASEs provide the mapping function of the abstract-syntax notation of the directory operation packages onto the services provided by the ROSE.

The Association Control Service Element (ACSE) supports the establishment and release of an application-association between a pair of AEs. Associations between a DUA and a DSA may be established only by the DUA. Only the initiator of an established association can release it.

Optionally, the Reliable Transfer Service Element (RTSE) may be used to reliably transfer the Application Protocol Data Units (APDUs) of the DISP.

6.2 Directory ROS-Objects and Contracts

ITU-T Rec. X.511 | ISO/IEC 9594-3 defines the abstract service between a DUA and the Directory which provides an access point to support a user accessing Directory services.

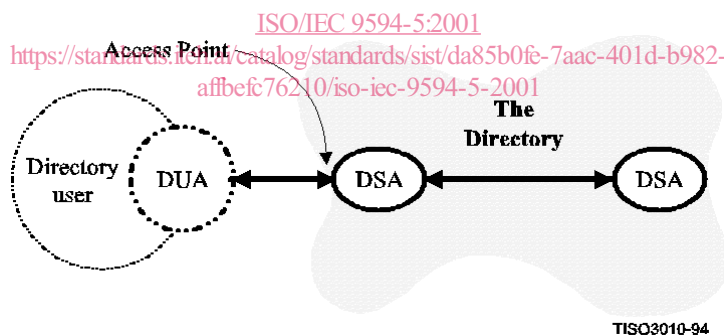
The **dua** class of ROS-object describes a DUA, being an instance of this class, as the initiator of the contract **dapContract**. This contract is referred to in these Directory Specifications as the Directory Abstract Service. It is specified as a ROS-based information object in 6.3.

```
dua ROS-OBJECT-CLASS ::= {
  INITIATES      { dapContract }
  ID              id-rosObject-dua }
```

The **directory** class of ROS-object describes the provider of the Directory Abstract Service. This provider is the responder of the **dapContract**.

```
directory ROS-OBJECT-CLASS ::= {
  RESPONDS      { dapContract }
  ID              id-rosObject-directory }
```

The Directory is further modelled, as depicted in Figure 1, as being represented to a DUA by a DSA which supports the particular access point concerned. ITU-T Rec. X.518 | ISO/IEC 9594-4 defines the interactions between a pair of DSAs within the Directory to support user requests which are chained.



The **directory** object is therefore manifested as a set interacting DSAs. Each DSA comprising the **directory** is an instance of the **dap-dsa** class. A **dap-dsa** object assumes the role of responder in the **dapContract**.

```
dap-dsa ROS-OBJECT-CLASS ::= {
  RESPONDS      { dapContract }
  ID              id-rosObject-dapDSA }
```

In addition to interacting with DUAs, DSAs interact with one another to achieve various objectives. In what follows, a number of contracts and ROS-objects expressing how DSAs participate in these contracts are defined. Any real DSA may instantiate one or more of these DSA ROS-objects.

The interactions between DSAs generally required to provide the Directory Abstract Service in the presence of a distributed DIB are defined as a **dspContract**. A DSA that participates in this contract is defined as a ROS-object of class **dsp-dsa**. The contract is referred to in these Directory Specifications as the DSA Abstract Service. It is specified as a ROS-based information object in 6.4.

```
dsp-dsa ROS-OBJECT-CLASS ::= {
  BOTH          { dspContract }
  ID              id-rosObject-dspDSA }
```


The Shadow Abstract Service specifies the shadowing of information between a shadow supplier and a shadow consumer DSA. This service is manifested in two forms and therefore is defined as two distinct contracts. They are specified as a ROS-based information objects in 6.5.

The **shadowConsumerContract** expresses the form of the service in which the shadow consumer, a ROS-object of class **initiating-consumer-dsa**, initiates the contract. A ROS-object of class **responding-supplier-dsa**, responds in this contract.

```
initiating-consumer-dsa ROS-OBJECT-CLASS ::= {
  INITIATES      { shadowConsumerContract }
  ID              id-rosObject-initiatingConsumerDSA }
```

```
responding-supplier-dsa ROS-OBJECT-CLASS ::= {
  RESPONDS      { shadowConsumerContract }
  ID              id-rosObject-respondingSupplierDSA }
```

The **shadowSupplierContract** expresses the form of the service in which the shadow supplier, a ROS-object of class **initiating-supplier-dsa**, initiates the contract. A ROS-object of class **responding-consumer-dsa**, responds in this contract.

```
initiating-supplier-dsa ROS-OBJECT-CLASS ::= {
  INITIATES      { shadowSupplierContract }
  ID              id-rosObject-initiatingSupplierDSA }
```

```
responding-consumer-dsa ROS-OBJECT-CLASS ::= {
  RESPONDS      { shadowSupplierContract }
  ID              id-rosObject-respondingConsumerDSA }
```

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The interactions between two DSAs to manage a set of operational bindings are defined as a **dopContract**.

```
dop-dsa ROS-OBJECT-CLASS ::= {
  BOTH          { dopContract }
  ID              id-rosObject-dopDSA }
```

<https://standards.iteh.ai/catalog/standards/sist/da85b0fe-7aac-401d-b982-affbec76210/iso-iec-9594-5-2001>

A DSA that participates in this contract is defined as a ROS-object of class **dop-dsa**. This contract is specified as a ROS-based information object in 6.6.

6.3 DAP Contract and Packages

The **dapContract** is defined as an information object of class **CONTRACT**.

```
dapContract CONTRACT ::= {
  CONNECTION      dapConnectionPackage
  INITIATOR CONSUMER OF { readPackage | searchPackage | modifyPackage }
  ID              id-contract-dap }
```

When a DUA and DSA from different open systems interact, this association contract may be realized as an OSI application layer protocol, referred to in these Directory Specifications as the Directory Access Protocol (DAP). The definition of this protocol in terms of an OSI application context is provided in 7.2.

The **dapContract** is composed of a connection package, **dapConnectionPackage**, and three operation packages, **readPackage**, **searchPackage** and **modifyPackage**.

The connection package, **dapConnectionPackage**, is defined as an information object of class **CONNECTION-PACKAGE**. The bind and unbind operations of this connection package, **directoryBind** and **directoryUnbind**, are defined in ITU-T Rec. X.511 | ISO/IEC 9594-3.

```
dapConnectionPackage CONNECTION-PACKAGE ::= {
  BIND      directoryBind
  UNBIND    directoryUnbind
  ID        id-package-dapConnection }
```