

Space data and information transfer systems — Cross support reference model — Space link extension services

ICS 49.140

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National foreword

This British Standard reproduces verbatim ISO 15396:1998 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee ACE/67, Data and information transfer standards for civil space applications, 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 the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO title page, pages ii to iv, pages 1 to 63 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 July 1998

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INTERNATIONAL STANDARD

**ISO
15396**

First edition
1998-05-01

Space data and information transfer systems — Cross support reference model — Space link extension services

*Systèmes de transfert des informations et données spatiales — Modèle de
référence pour le support croisé — Services S.L.E.*



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Avant-propos

L'ISO (Organisation internationale de normalisation) est une fédération mondiale d'organismes nationaux de normalisation (comités membres de l'ISO). L'élaboration des Normes internationales est en général confiée aux comités techniques de l'ISO. Chaque comité membre intéressé par une étude a le droit de faire Partie du comité technique créé à cet effet. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'ISO participent également aux travaux. L'ISO collabore étroitement avec la Commission électrotechnique internationale (CEI) en ce qui concerne la normalisation électrotechnique.

Les projets de Normes internationales adoptés par les comités techniques sont soumis aux comités membres pour vote. Leur publication comme Normes internationales requiert l'approbation de 75 % au moins des comités membres votants.

La Norme internationale ISO 15396 a été élaborée par le comité technique ISO/TC 20, *Aéronautique et espace*, sous-comité SC 13, *Systèmes de transfert des informations et données spatiales*.

Descripteurs: Système de navigation, engin spatial, commande d'aéronef, système de données spatiales, échange d'information, transfert de données, procédure de transmission de données, service.

1 Scope

This International Standard specifies the requirements for space link extension services for a cross support reference model for space data and information transfer systems.

2 Requirements

Requirements are the technical recommendations made in the following publication (reproduced on the following pages), which is adopted as an International Standard:

CCSDS 910.4-B-1, May 1996, *Recommendation for space data system standards — Cross support reference model — Part 1: Space link extension services*.

For the purposes of international standardization, the modifications outlined below shall apply to the following pages of publication CCSDS 910.4-B-1.

Pages i to iv

This part contains information which is relevant to the CCSDS publication only.

Pages 1-6 and 1-7

Add the following information to the references indicated:

[2] Document CCSDS 102.0-B-4, May 1996, is equivalent to ISO 13419:1977.

[3] Document CCSDS 101.0-B-3, May 1992, is equivalent to ISO 11754:1994.

[4] Document CCSDS 701.0-B-2, November 1992, is equivalent to ISO 13420:1997.

[5] Document CCSDS 201.0-B-2, May 1996, is equivalent to ISO 12171:—¹⁾.

[6] Document CCSDS 202.0-B-2, November 1992, is equivalent to ISO 12172:—¹⁾.

[7] Document CCSDS 203.0-B-1, January 1987, is equivalent to ISO 12174:—¹⁾.

Page 1-7

ISO 8824:1990 has been replaced. Reference [13] should read as follows:

[13] ISO/IEC 8824-1:1995, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*, and its Amendment 1:1996.

ISO/IEC 8824-2:1995, *Information technology — Abstract Syntax Notation One (ASN.1): Information object specification*, and its Amendment 1:1996.

ISO/IEC 8824-3:1995, *Information technology — Abstract Syntax Notation One (ASN.1): Constraint specification*.

ISO/IEC 8824-4:1995, *Information technology — Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*.

3 Revision of publication CCSDS 910.4-B-1

It has been agreed with the Consultative Committee for Space Data Systems that Subcommittee ISO/TC 20/SC 13 will be consulted in the event of any revision or amendment of publication CCSDS 910.4-B-1. To this end, NASA will act as a liaison body between CCSDS and ISO.

¹⁾ To be published.

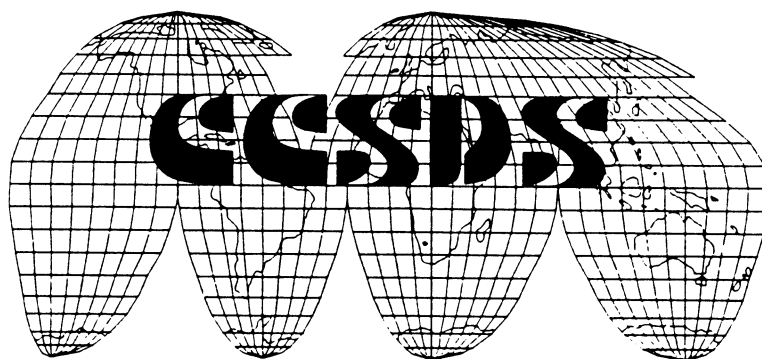
Consultative Committee for Space Data Systems

RECOMMENDATION FOR SPACE
DATA SYSTEM STANDARDS

CROSS SUPPORT REFERENCE MODEL PART 1 SPACE LINK EXTENSION SERVICES

CCSDS 910.4-B-1
BLUE BOOK

May 1996



RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

Authority

Issue:	Blue Book, Issue 1
Date:	May 1996
Location:	Pasadena, California, USA

This document has been approved for publication by the Management Council of the Consultative Committee for Space Data Systems (CCSDS) and represents the consensus technical agreement of the participating CCSDS Member Agencies. The procedure for review and authorization of CCSDS Recommendations is detailed in reference [1], and the record of Agency participation in the authorization of this document can be obtained from the CCSDS Secretariat at the address below.

This Recommendation is published and maintained by:

CCSDS Secretariat
Program Integration Division (Code OI)
National Aeronautics and Space Administration
Washington, DC 20546, USA

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

Statement of intent

The Consultative Committee for Space Data Systems (CCSDS) is an organization officially established by the management of member space Agencies. The Committee meets periodically to address data systems problems that are common to all participants, and to formulate sound technical solutions to these problems. Inasmuch as participation in the CCSDS is completely voluntary, the results of Committee actions are termed **Recommendations** and are not considered binding on any Agency.

This **Recommendation** is issued by, and represents the consensus of, the CCSDS Plenary body. Agency endorsement of this **Recommendation** is entirely voluntary. Endorsement, however, indicates the following understandings:

- Whenever an Agency establishes a CCSDS-related **standard**, this **standard** will be in accord with the relevant **Recommendation**. Establishing such a **standard** does not preclude other provisions which an Agency may develop.
- Whenever an Agency establishes a CCSDS-related **standard**, the Agency will provide other CCSDS member Agencies with the following information:
 - The **standard** itself.
 - The anticipated date of initial operational capability.
 - The anticipated duration of operational service.
- Specific service arrangements shall be made via memoranda of agreement. Neither this **Recommendation** nor any ensuing **standard** is a substitute for a memorandum of agreement.

No later than five years from its date of issuance, this **Recommendation** will be reviewed by the CCSDS to determine whether it should: (1) remain in effect without change; (2) be changed to reflect the impact of new technologies, new requirements, or new directions; or, (3) be retired or canceled.

In those instances when a new version of a **Recommendation** is issued, existing CCSDS-related Agency standards and implementations are not negated or deemed to be non-CCSDS compatible. It is the responsibility of each Agency to determine when such standards or implementations are to be modified. Each Agency is, however, strongly encouraged to direct planning for its new standards and implementations towards the later version of the Recommendation.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

Foreword

This document is a technical **Recommendation** for use in developing ground systems for space missions and has been prepared by the **Consultative Committee for Space Data Systems (CCSDS)**. The Cross Support reference model described herein is intended for missions that are cross-supported between Agencies of the CCSDS.

This **Recommendation** establishes a common framework and provides a common basis for the specification of data services that extend the space to ground communication services previously defined by CCSDS. It allows implementing organizations within each Agency to proceed coherently with the development of compatible derived Standards for the ground systems that are within their cognizance. Derived Agency Standards may implement only a subset of the optional features allowed by the **Recommendation** and may incorporate features not addressed by the **Recommendation**.

Through the process of normal evolution, it is expected that expansion, deletion or modification to this document may occur. This **Recommendation** is therefore subject to CCSDS document management and change control procedures, as defined in reference [1].

At time of publication, the active Member and Observer Agencies of the CCSDS were

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- Canadian Space Agency (CSA)/Canada.
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- Centre National d'Etudes Spatiales (CNES)/France.
- Deutsche Forschungsanstalt für Luft- und Raumfahrt e.V. (DLR)/Germany.
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- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- National Aeronautics and Space Administration (NASA HQ)/USA.
- National Space Development Agency of Japan (NASDA)/Japan.

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- Australian Space Office (ASO)/Australia.
- Austrian Space Agency (ASA)/Austria.
- Belgian Science Policy Office (SPO)/Belgium.
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- Chinese Academy of Space Technology (CAST)/China.
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- Danish Space Research Institute (DSRI)/Denmark.
- European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)/Europe.
- European Telecommunications Satellite Organization (EUTELSAT)/Europe.
- Hellenic National Space Committee (HNSC)/Greece.
- Indian Space Research Organization (ISRO)/India.
- Industry Canada/Communications Research Centre (CRC)/Canada.
- Institute of Space and Astronautical Science (ISAS)/Japan.
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- KFKI Research Institute for Particle & Nuclear Physics (KFKI)/Hungary.
- MIKOMTEK: CSIR (CSIR)/Republic of South Africa.
- Ministry of Communications (MOC)/Israel.
- National Oceanic & Atmospheric Administration (NOAA)/USA.
- National Space Program Office (NSPO)/Taiwan.
- Swedish Space Corporation (SSC)/Sweden.
- United States Geological Survey (USGS)/USA.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

Document control

Document	Title	Date	Status
CCSDS 910.4-B-1	Cross Support Reference Models—Part 1: Space Link Extension Services	May 1996	Original Issue

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

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RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

1 Introduction

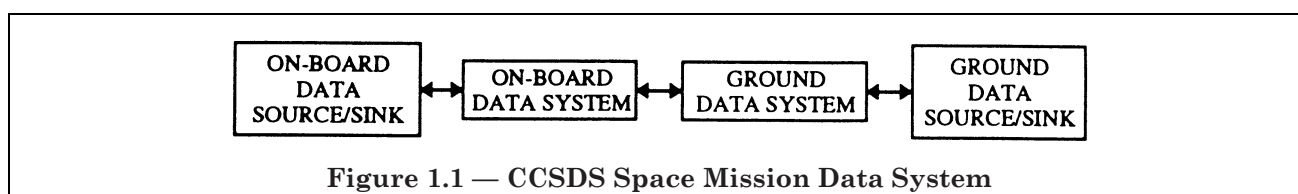
1.1 Purpose of this recommendation

1.1.1 Baseline and reference for SLE service specifications

This Recommendation defines a Cross Support reference model which provides a common basis for coordinating the development of CCSDS Recommendations for Space Link Extension (SLE) service specifications and serves as a reference to maintain the consistency of these Recommendations.

1.1.2 Relationship to space link recommendations

1.1.2.1 CCSDS Space Link Recommendations (Advanced Orbiting System (AOS), Packet Telemetry, and Telecommand, references [2]–[7]) define formats and protocols for the transfer of data from/to data sources/sinks on board a space vehicle to/from data sinks/sources on the ground as shown on Figure 1.1. These Space Link protocols are designed to work efficiently in the noisy, high-delay environment of space/ground radio links; thus they do not carry information needed to configure and operate the ground systems that link numerous ground stations with the ground sinks and sources of data.



1.1.2.2 The SLE Recommendations complement the CCSDS Space Link Recommendations with a range of services that are required to configure, operate, and supervise the ground data systems.

1.1.2.3 The SLE Recommendations apply to data systems that are able 1) to receive CCSDS Space Link data structures from a spacecraft via a Space Link, or 2) to send CCSDS Space Link data structures to a spacecraft via a Space Link, or 3) to transfer such CCSDS Space Link data structures between ground-based entities.

1.1.3 SLE services

SLE services comprise:

- a) SLE transfer services, which are concerned with the ground part of the data transfer described in 1.1.2. This transfer is either within the ground data system or between the ground data system and the ground data sources/sinks.
- b) SLE management services, which control the scheduling and provision of SLE transfer services by ground systems.

1.1.4 SLE systems

Ground systems that provide services that comply with the CCSDS Recommendations for SLE service specifications are called SLE systems.

1.1.5 Framework for SLE services

This Recommendation provides the framework for definition of SLE service specifications to be used in support of space missions. This framework comprises:

- a) the identification of an SLE system and of its environment;
- b) an architectural model of an SLE system including:
 - 1) a functional view;
 - 2) a management view;
- c) the common characteristics of SLE services and the template for SLE service specifications:
 - 1) each individual SLE service specification expresses its requirement on supporting telecommunication services in a respective quality-of-service clause;
 - 2) it is assumed that the provider and user of a given SLE service ensure that appropriate telecommunication facilities are in place;
- d) the identification of the SLE transfer services;

NOTE In d), SLE transfer services are identified; however, the complete service specification will be provided in a separate Recommendation.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

1.2 Scope

1.2.1 The scope of this Recommendation is the definition of all concepts and terms that establish a common basis for coordinating the development of CCSDS Recommendations for SLE services specifications. In defining these concepts and terms the following assumptions are made:

- a) the context is that of a single space mission;
- b) within this space mission a single spacecraft is considered;
- c) this spacecraft's telemetry and telecommand are compliant with CCSDS Space Link Recommendations;
- d) all ground end-users (i.e., data sinks or sources) are affiliated with a single mission management entity.

1.2.2 The following points are not covered by this Recommendation:

1.2.2.1 Although sharing ground systems between multiple space missions or between multiple spacecraft of the same space mission is not explicitly modeled, this Recommendation does not in any way preclude sharing ground systems.

1.2.2.2 Ground systems and/or services that are not directly concerned with the transport of data compliant to CCSDS Space Link Recommendations are not described. Processing data held within the data fields of Source Packet Protocol Data Units (PDUs) described in CCSDS Packet Telemetry, Telecommand, and AOS Recommendations (references [2]–[7]) is outside the scope of this Recommendation.

1.2.2.3 This reference model assumes that ground communications services are used in conjunction with the SLE services to support a space mission, but does not explicitly model these communications services.

1.3 Applicability

1.3.1 Applicability of this recommendation

This Recommendation serves as a guideline for the development of compatible Agency standards for SLE systems. Systems embraced by this Recommendation include manned and unmanned free-flying spacecraft and space transportation systems. This Recommendation is particularly relevant to the SLE systems that are involved in cross support.

1.3.2 Limit of applicability

This Recommendation is neither a specification of, nor a design for, real SLE systems that may be implemented for the control and monitoring of existing or future missions.

1.4 Rationale

The primary goal of CCSDS is to increase the level of interoperability among Agencies. This Recommendation furthers that goal by establishing the basis for a set of SLE services to be used in the area where most cross-support activity occurs: between the tracking stations or ground data handling systems of various Agencies and the mission specific components of a mission ground system. Reference [11], *Cross Support Concept — Part 1: Space Link Extension Services*, provides further discussion of the rationale for this Recommendation.

1.5 Document structure

This Recommendation is organized as follows:

- a) Section 1 provides purpose, scope, applicability and rationale of this Recommendation and lists the definitions, conventions, and references used throughout the Recommendation.
- b) Section 2 provides the context of cross support, presents the cross-support documentation structure, and shows how this Recommendation fits into that framework. It expands on the scope of this Recommendation to provide an overview of the document.
- c) Section 3 defines the SLE system environment, data handled by an SLE system, and introduces SLE services.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

d) Section 4 defines an architectural model for the SLE system. This architectural model comprises two views:

1) A functional view which defines the system concepts, including functions and data, from which the SLE services are derived. In this functional view, the SLE system is decomposed into SLE Functional Groups (SLE-FGs), which implement and augment the ground side of the Space Link protocols described in CCSDS Packet Telemetry, Telecommand, and AOS Recommendations (references [2]–[7]).

2) A cross-support management view, which defines the management interactions between the entities involved in the provision of SLE services and provides the baseline for the SLE Service Management Specification. In this management view, the SLE system is decomposed into SLE Complexes and the notion of SLE Service Package is introduced.

e) Section 5 defines the common characteristics of SLE services, provides the template for SLE transfer services specifications, and provides an initial description of each SLE service including operations and parameters at the corresponding ports.

f) Annex A expands upon the description, in Section 3, of the data handled in SLE systems.

1.6 Definitions

1.6.1 Definitions from references

This Recommendation uses the Abstract Service Definition Conventions (ASDC) methodology, which provides the means to create a model of a system composed of objects that provide services to one another. This Architecture Model is composed of abstract-objects which have abstract ports, through which they provide abstract-services to other abstract-objects. The definitions below are from reference [10].

1.6.1.1

abstract-object

an abstract-object is a functional entity which interacts with other abstract-objects. Objects are of different types, which determine their function and behavior. These abstract-objects are characterized by their interfaces, which are called abstract-ports, and the operations which can be performed through those ports

1.6.1.2

abstract-service

ASDC defines an abstract-service as a set of capabilities that one abstract-object offers to another by means of one or more of its abstract-ports. For the purpose of defining SLE Services in this reference model, an abstract-service is considered to be the capability provided by a set of operations that an abstract-object exposes at one or more of its abstract-ports

1.6.1.3

abstract refinement

a model may be defined as consisting of a few high-level objects. These objects may be decomposed into lower-level, component objects. This decomposition is called abstract refinement

NOTE To improve readability, the term “abstract” is used from here onward only when it is necessary to distinguish a feature of the model from its implementation, or to emphasize the use of an ASDC concept or term.

1.6.1.4

port types

ports that are involved in providing different services are said to be of different types

1.6.1.5

symmetric/asymmetric ports

two ports (of two objects) involved in the provision of a service may be either symmetric ports or asymmetric ports. The ports are symmetric if each offers all of the operations associated with the service. The ports are asymmetric if each offers different operations; in this case, one port is called a consumer, and the other is called a supplier

1.6.1.6

service user/provider

an object that offers a service to another by means of one or more of its ports is called a service provider (provider). The other object is called a service user (user). An object may be a provider of some services and a user of others

NOTE “Provide” is used in the sense of “make available to be used” and does not necessarily imply that the service is being used.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

1.6.1.7

abstract binding

when two abstract ports of the same type have an association established between them such that an abstract service can be provided, the two ports are said to be bound. The act of establishing such an association is called abstract binding

1.6.1.8

operation

an operation is a procedure that one object (the invoker) can request of another (the performer) through a port pair bound within the terms of an agreement

NOTE 1 The relationships among the terms user/provider, supplier/consumer, and invoker/performer are explained in reference [10]. Briefly:

NOTE 2 The terms user and provider are used to distinguish the roles of two interacting objects. Usually these terms are applied so as to indicate which object (the provider) is performing a function on behalf of the other object (the user). In this Recommendation, when two objects are involved in provision of a service, the object closer to the Space Link is considered to be the provider of the service, and the object further from the Space Link is considered to be the user, regardless of the direction of data flow.

NOTE 3 The terms consumer and supplier are used to distinguish the roles of two ports, each attached to one of two objects, that are bound. In this Recommendation, these terms indicate direction of transfer of data: *from* the supplier port *to* the consumer port.

NOTE 4 The terms invoker and performer are used to describe the interaction between two objects, as the operations that constitute the service occur. One object invokes an operation which is performed by the other. For most services, each object, whether consumer or supplier, invokes some operations and performs others.

1.6.2 Definitions in this document

The definitions provided below are those needed for understanding this Recommendation as a whole. Many other terms are defined throughout this Recommendation.

1.6.2.1

return data

for the purposes of this Recommendation, Return Data is all data that is sent from the space element to the ground element (e.g., telemetry)

1.6.2.2

forward data

for the purposes of this Recommendation, forward data is all data that is sent from the ground element to the space element (e.g., telecommand)

1.6.3 Conventions**1.6.3.1 Style**

Within this Recommendation, each formal statement stands in a paragraph by itself and is identified uniquely by a subsection number or by a combination of subsection number and list item number.

1.6.3.2 Notes

Notes are not formally part of this Recommendation. They are isolated from the formal statements and are introduced by the word NOTE.

EXAMPLE

NOTE This is an example of a note.

1.6.3.3 Usage of Capital Letters

Names of system components, data units, and other elements of the reference model are shown with the first letter of each word capitalized.

1.6.3.4 Types And Instances

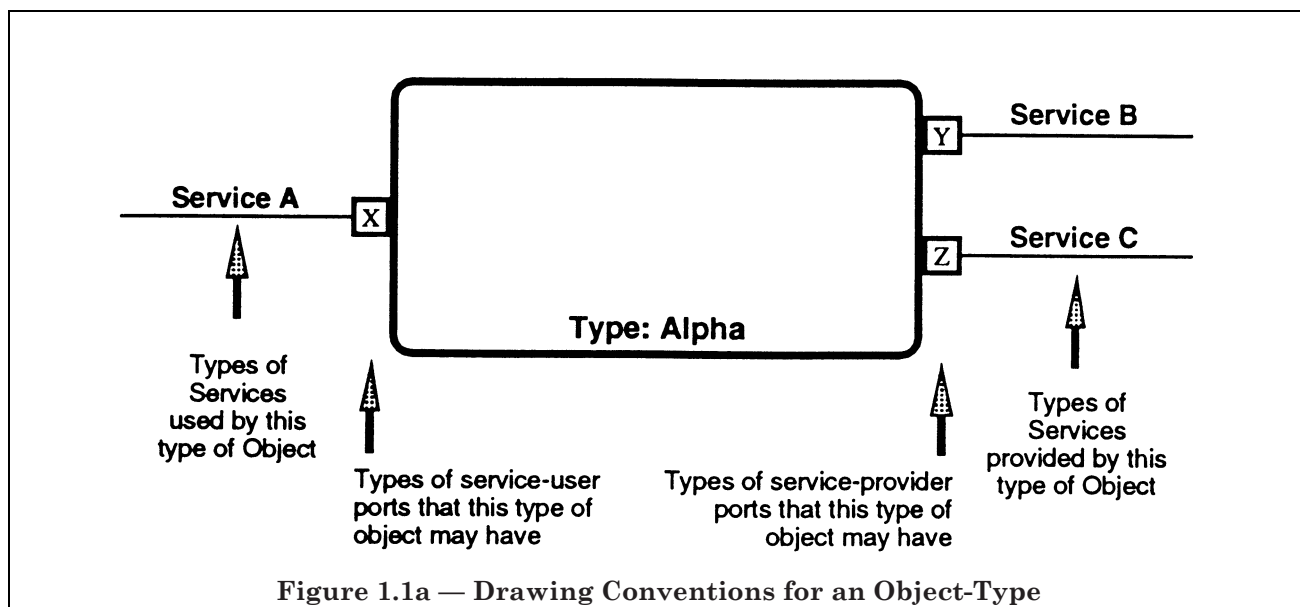
As noted in 1.6.1, ASDC allows definition of groups, or classes, of objects that can provide the same services. Such objects are said to be of the same *type*. In this reference model, it is sometimes necessary to distinguish between characteristics that are common to all objects of a type and characteristics of a particular object of a type. Often, this is clear from context, but when necessary to avoid ambiguity the word “instance” is used to emphasize the notion of a single object of a type; the word “type” or the phrase “of a type” is used to refer to all objects of the same class. Generally, “the <type-name>” is used in describing the object-type. Often, characteristics of a class (i.e., objects of a type) are defined by referring to “a (or any, every, each) <type-name>”. When specific objects are discussed, they are given names (e.g., X, Y, Mission ABC). This wording is also used with regard to ports, services, and operations defined in the reference model.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES

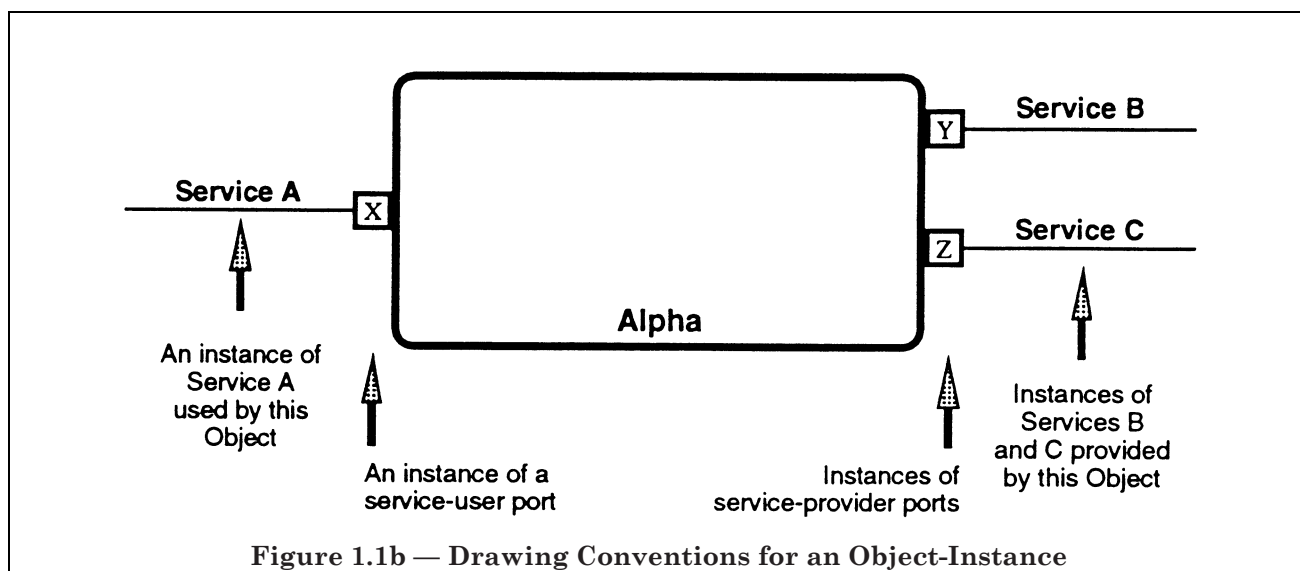
1.6.3.5 Drawing Conventions

In figures illustrating this reference model, the following conventions are used.

a) A type of (abstract) object is shown as a round-cornered box. The type-name is shown at the bottom of the box, preceded by the word “Type” and a colon; see Figure 1.1a. The initial letter of the type-name is always upper case. The ports and services associated with an object type are also types.



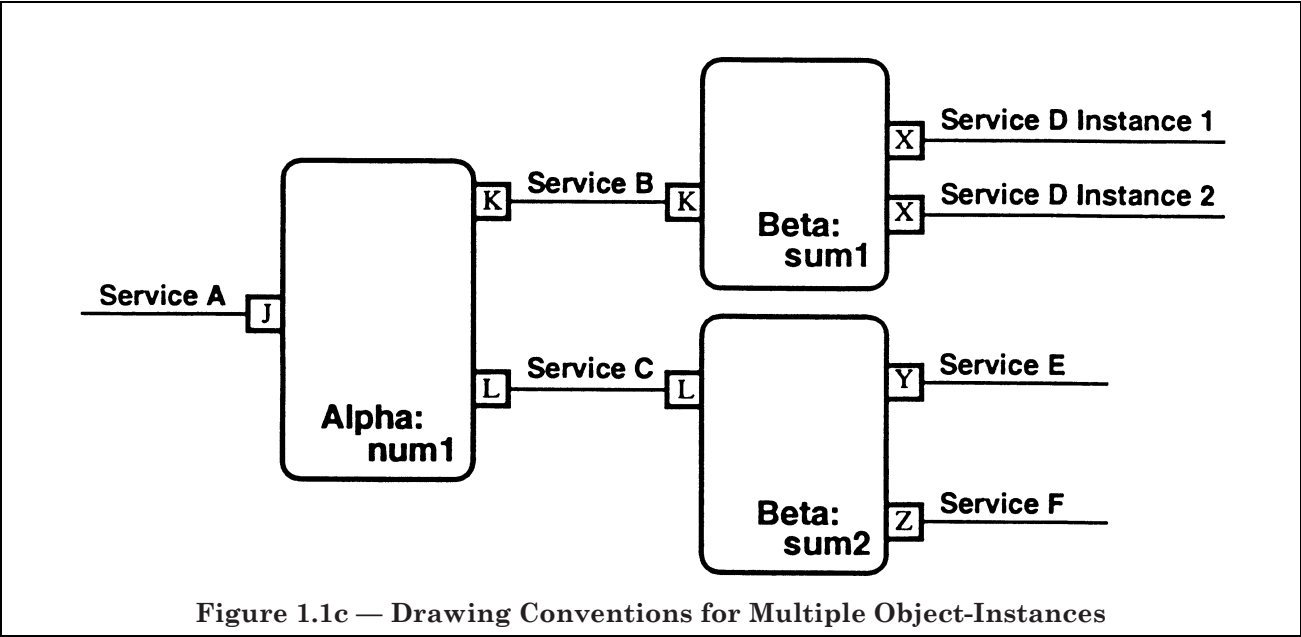
b) An instance of an object is shown as a round-cornered box. The type-name is again shown at the bottom of the box, but is *not* preceded by the word “type” and a colon; see Figure 1.1b. The ports and services associated with an instance of an object type are also instances.



c) If a figure shows two or more instances of the same type of object, each is given a name by showing the type-name followed by a colon and the name of the instance. The initial letter of the instance-name is always lower case. See Figure 1.1c.

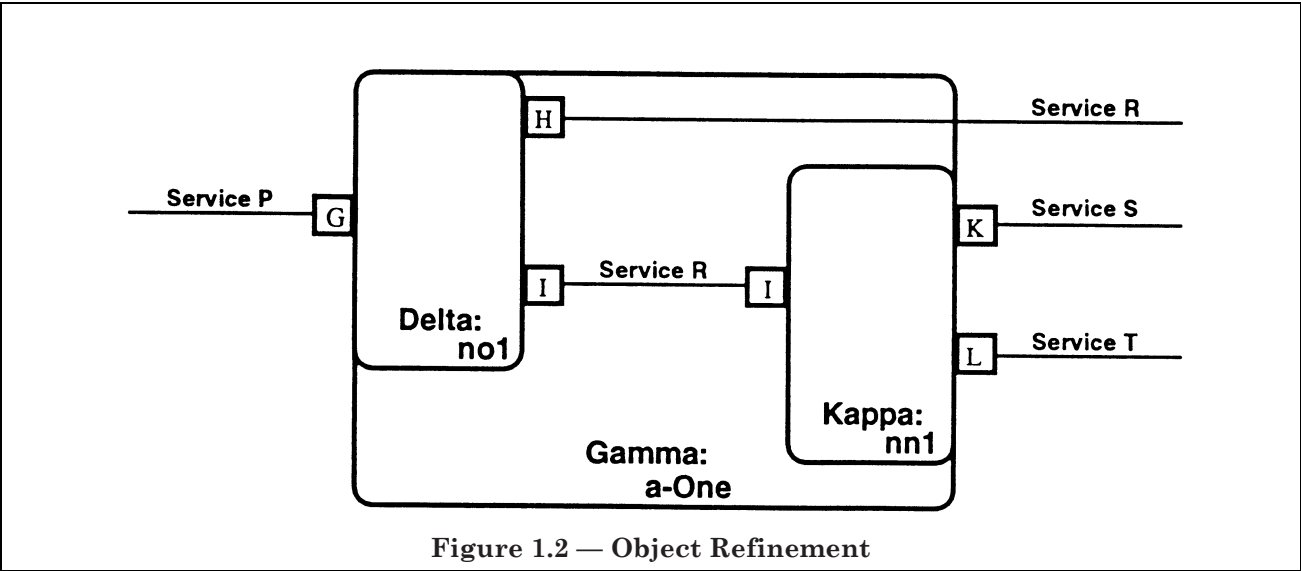
d) Instances of a port type are distinguished by the names of the service instances that are provided at the port. Multiple instances of a single service are permitted. See example instances 1 and 2 of service D in Figure 1.1c.

RECOMMENDATION FOR CROSS SUPPORT REFERENCE MODEL — PART 1: SLE SERVICES



1.6.3.6 Object Refinement

In ASDC terms, this document decomposes a system and other objects into component objects. When a port of a component object is exposed as a port of the parent object, it is shown as illustrated by ports G, H, K, and L in Figure 1.2.



1.7 References

The following documents are referenced in the text of this Recommendation. At the time of publication, the editions indicated were valid. All documents are subject to revision, and users of this Recommendation are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. The CCSDS Secretariat maintains a register of currently valid CCSDS Recommendations.

[1] *Procedures Manual for the Consultative Committee for Space Data Systems*. CCSDS A00.0-Y-6. Yellow Book. Issue 6. Washington, D.C.: CCSDS, May 1994.

[2] *Packet Telemetry*. Recommendation for Space Data System Standards, CCSDS 102.0-B-4. Blue Book. Issue 4. Washington, D.C.: CCSDS, May 1996.