INTERNATIONAL STANDARD

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Information technology — Open Systems Interconnection — Network Service Definition

Technologies de l'information — Interconnexion des systèmes ouverts — Définition du service de réseau

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Content

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 8348 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Sub-Committee SC 6, *Telecommunications and information exchange between systems*, in collaboration with CCITT. The identical text is published as CCITT Recommendation X.213.

This second edition cancels and replaces the first edition (ISO 8348:1987), which has been technically revised.

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

Introduction

This Recommendation | International Standard is one of a set of CCITT Recommendations and International Standards produced to facilitate the interconnection of computer systems. It is related to other CCITT Recommendations and International Standards in the set as defined by the Reference Model of Open Systems Interconnection (OSI). The OSI Reference Model (CCITT Rec. X.200 | ISO 7498) subdivides the area of standardization for interconnection into a series of layers of specification, each of a manageable size.

This CCITT Recommendation | International Standard defines the Service provided by the Network Layer to the Transport Layer at the Boundary between the Network and Transport Layers of the Reference Model. It provides for the designers of Transport protocols a definition of the Network Service existing to support the Transport protocol and for the designers of Network protocols a definition of the services to be made available through the action of the Network protocol over the underlying service. This relationship is illustrated in the figure.

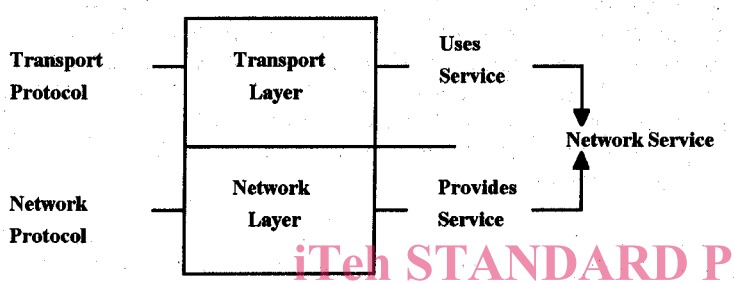

Figure – Relationship of the Network Service to OSI Network and Transport protocols

The use of the word "Network" to name the "Network" Layer of the OSI Reference Model should be distinguished from the use of the word "network" to denote a communications network as conventionally understood. To facilitate this distinction, the term "subnetwork" is used for a collection of physical equipment, commonly called a "network" (see CCITT Rec. X.200 | ISO 7498). Subnetworks may be either public networks or privately supplied networks. In the case of public networks, their properties may be determined by separate CCITT Recommendations such as Recommendation X.21 for a circuit-switched network or Recommendation X.25 for a packet-switched network.

Throughout the set of OSI CCITT Recommendations and International Standards the term "Service" refers to the abstract capability provided by one layer of the OSI Reference Model to the layer above it. Thus, the Network Service defined in this Recommendation | International Standard is a conceptual architectural Service, Independent of administrative divisions.

NOTE 1 – It is important to distinguish the specialized use of the term "Service" within the set of OSI CCITT Recommendations and International Standards from its use elsewhere to describe the provision of a service by an organization (such as the provision of a service, as defined in other CCITT Recommendations, by an Administration).

Any particular subnetwork may or may not support the OSI Network Service. The OSI Network Service may be provided by a combination of one or more subnetworks and optional additional functions between or outside these subnetworks.

INTERNATIONAL STANDARD

CCITT RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – NETWORK SERVICE DEFINITION

SECTION 1 – GENERAL

1 Scope

This Recommendation | International Standard defines the OSI Network Service in terms of

a) the primitive actions and events of the Service;

b) the parameters associated with each primitive action and event, and the form which they take;

c) the interrelationship between, and the valid sequences of, these actions and events.

The principal objectives of this Recommendation | International Standard are

1) to specify the characteristics of a conceptual Network Service and thus, supplement the Reference Model in guiding the development of Network Layer protocols;

2) to encourage convergence of the capabilities offered by providers of subnetworks;

3) to provide a basis for the individual enhancement of existing heterogeneous subnetworks to a common subnetwork-independent Network Service to enable them to be concatenated for the purpose of providing global communication. (Such concatenation may involve optional additional functions which are not defined in this Recommendation | International Standard.) A definition of the quality of service is an important element of this Recommendation | International Standard;

4) to provide a basis for the development and implementation of subnetwork-independent Transport Layer protocols decoupled from the variability of underlying public and private subnetworks and their specific interface requirements.

This Recommendation | International Standard does not specify individual implementations or products nor does it constrain the implementation of entities and interfaces within a system.

There is no conformance of equipment to this Recommendation | International Standard. Instead, conformance is achieved through implementation of conforming OSI Network protocols which fulfill the Network Service defined in this Recommendation | International Standard.

2 Normative references

The following CCITT 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 International 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 CCITT Recommendations and International Standards listed below. Members of the IEC and ISO maintain registers of currently valid International Standards. The CCITT Secretariat maintains a list of the currently valid CCITT Recommendations.

2.1 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1988), *Reference model of Open Systems Interconnection for CCITT Applications.*

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

- CCITT Recommendation X.210 (1988), *Open Systems Interconnection layer service definition conventions.*

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

- CCITT Recommendation X.224 (1988), *Transport protocol specification for Open Systems Interconnection for CCITT applications.*

  ISO/IEC 8073:1992, *Information technology – Telecommunications and information exchange between systems – Open Systems Interconnection – Protocol for providing the connection-mode transport services.*

2.2 Additional references

- CCITT Recommendation E.163 (1998), *Numbering plan for the international telephone service.*
- CCITT Recommendation E.164 (1991), *The numbering plan for the ISDN era.*
- CCITT Recommendation F.69 (1988), *Plan for telex destination codes.*
- CCITT Recommendation X.121 (1992), *International numbering plan for public data networks.*
- CCITT Recommendation X.300, (1988) *General principles for interworking between public networks and between public networks and other networks for the provision of data transmission services.*
- ISO/IEC 646: 1991, *Information technology – ISO 7-bit coded character set for information interchange.*
- ISO 2375: 1985, *Data processing – Procedure for registration of escape sequences.*
- ISO 3166: 1988, *Codes for the representation of names of countries.*
- ISO 6523: 1984, *Data interchange – Structures for the identification of organizations.*
- ISO 7498:1984/Add. 1:1987, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Addendum 1: Connectionless-mode transmission.*
- ISO 8648:1988, *Information processing systems – Open Systems Interconnection – Internal organization of the Network Layer.*

3 Definitions

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

3.1 Basic reference model definitions

This Recommendation | International Standard is based on the concepts developed in the Basic Reference Model for Open Systems Interconnection and makes use of the following terms defined in CCITT Rec. X.200 | ISO 7498:

a) expedited Network-Service-data-unit;

b) Network-address,

c) Network Connection;

d) Network-entity,

e) Network-protocol control information,

f) Network-protocol data unit,

g) Network Layer.

h) Network-relay.

i) Network-routing,

j) Network Service;

k) Network-Service-access-point;

l) Network-Service-access-point-address;

m) Network-Service-data-unit;

n) OSI environment,

o) subnetwork;

p) title.

3.2 Service conventions definitions

This Recommendation | International Standard also makes use of the following terms defined in CCITT Rec. X.210 | ISO/TR 8509, as they apply to the Network Layer:

a) confirm;

b) indication;

c) Network Service user;

d) Network Service provider;

e) primitive;

f) request;

g) response.

3.3 Network Service definitions

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

3.3.1 calling NS user: An NS user that initiates an NC establishment request.

3.3.2 called NS user: An NS user with whom a calling NS user wishes to establish an NC.

NOTE – Calling NS users and called NS users are defined with respect to a single NC. An NS user can be both a calling and a called NS user simultaneously.

3.3.3 generic address: An address which identifies a set of NSAPs rather than a single specific NSAP.

3.3.4 Network Connection: An association established by a Network Layer between two NS users for the transfer of data, which provides explicit identification of a set of Network data transmissions and agreement concerning the services to be provided by the set.

NOTE – This definition clarifies that given in CCITT Rec. X.200 | ISO 7498.

3.3.5 Network connection-mode Data Transmission: The transfer of an NSDU from a source NSAP to a destination NSAP within the context of an NC that has previously been established

3.3.6 Network connectionless-mode Data Transmission: The transmission of an NSDU from a source NSAP to a destination NSAP outside the context of an NC and without any requirement to maintain any logical relationship among multiple invocations.

3.4 Network addressing definitions

Annex A, describing network addressing makes use of the following terms as defined below:

3.4.1 DTE address: Information used to identify a point of attachment to a public data network.

3.4.2 subnetwork point of attachment: A point at which a real end system, interworking unit, or real subnetwork is attached to a real subnetwork, and a conceptual point at which a subnetwork service is offered within an end or intermediate system.

3.4.3 subnetwork point of attachment address: Information used in the context of a particular real subnetwork to identify a subnetwork point of attachment; or information used in the context of a particular subnetwork to identify the conceptual point within an end or intermediate system at which the subnetwork service is offered. This term is used interchangeably with the (equivalent) shortened form *subnetwork address*.

3.4.4 network protocol address information: Information encoded in a Network protocol data unit to carry the semantics of a Network service access point address. (This is known as an "address signal" or as the "coding of an address signal" in the public network environment.)

3.4.5 naming domain: A context within which a name allocated by a naming authority is unambiguous. Where the name is an address, the context within which the name is allocated is called an *addressing domain*.

3.4.6 global network addressing domain: An addressing domain consisting of all of the Network service access point addresses in the OSI environment.

3.4.7 network addressing domain: A subset of the global network addressing domain consisting of all of the Network service access point addresses allocated by one or more addressing authorities.

3.4.8 naming authority: That which allocated names from a specified naming domain, and which ensures that names so allocated are unambiguous. Where the naming authority allocates addresses, it is called an *addressing authority*.

3.4.9 network addressing authority: An addressing authority that assigns and administers Network service access point addresses within one or more network addressing domains.

3.4.10 abstract syntax: A notation which enables data types to be defined, and values of those types specified, without determining the way in which they will be represented (encoded) for transfer by protocols.

3.5 Network layer architecture definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.300 and ISO 8648.

a) subnetwork;

b) real subnetwork;

c) subnetwork service;

d) real end system;

e) interworking unit;

f) intermediate system;

g) relay entity.

4 Abbreviations

AFI	Authority and format identifier
CC	Country code
COR	Confirmation of receipt
DCC	Data country code
DSP	Domain specific part
ENSDU	Expedited Network-Service-data-unit
ICD	International code designator
IDI	Initial domain identifier

IDP	Initial domain part
ISDN	Integrated services digital network
N	Network
NC	Network Connection
NL	Network Layer
NPAI	Network protocol addressing information
NPDU	Network protocol data unit
NS	Network Service
NSAP	Network-Service-access-point
NSDU	Network-Service-data-unit
OSI	Open Systems Interconnection
PSTN	Public switched telephone network
PTT	Postal, telephone and telegraph
QOS	Quality of Service
RPF	Reference publication format
SNPA	Subnetwork point of attachment

5 Conventions

5.1 General conventions

This Service Definition uses the descriptive conventions given by CCITT Rec. X.210 | ISO/TR 8509.

The layer service model, service primitives, and time-sequence diagrams taken from those conventions are entirely abstract descriptions; they do not represent a specification for implementation.

5.2 Parameters

Service primitives, used to represent service-user/service-provider interactions (see CCITT Rec. X.210 | ISO/TR 8509), convey parameters which indicate information available in the user/provider interaction.

The parameters which apply to each group of Network Service primitives are set out in tables in clauses 12 to 14 and 19. Each "X" in the tables indicates that the primitive labeling the column in which it falls may carry the parameter labeling the row in which it falls.

Some entries are further qualified by items in brackets. These may be

a) an indication that the parameter is conditional in some way:

   (C) indicates that the parameter is not present on the primitive for every NC; the parameter definition describes the conditions under which the parameter is present or absent;

b) a parameter specific constraint:

   (=) indicates that the value supplied in an indication or confirm primitive is always identical to that supplied in the corresponding request or response primitive occurring at the peer NSAP;

c) an indication that some note applies to the entry:

   (Note x) indicates that the referenced note contains additional information pertaining to the parameter and its use.

In any particular interface, not all parameters need be explicitly stated. Some may be implicitly associated with the NSAP at which the primitive is issued.

5.3 NC endpoint identification convention

If an NS user needs to distinguish among several NCs at the same NSAP, then a local NC endpoint identification mechanism must be provided. All primitives issued at such an NSAP would be required to use this mechanism to identify NCs. Such an implicit identification is not described as a parameter of the service primitives in this Service Definition.

NOTE – The implicit NC endpoint identification must not be confused with the address parameters of the N-CONNECT primitives (see 12.2).

6 Overview and general characteristics

The Network Service provides for the transparent transfer of data (i.e., NS-user-data) between NS users. It makes invisible to these NS users the way in which supporting communications resources are utilized to achieve this transfer.

In particular, the Network Service provides for the following:

a) *Independence of underlying transmission media* – The Network Service relieves NS users from all concerns regarding how various subnetworks are used to provide the Network Service. The Network Service hides from the NS user differences in the transfer of data over heterogeneous subnetworks, other than quality of service.

b) *End-to-end transfer* – The Network Service provides for transfer of NS-user-data between NS users in end systems. All routing and relaying functions are performed by the NS provider including the case where several similar or dissimilar transmission resources are used in tandem or in parallel.

c) *Transparency of transferred information* – The Network Service provides for the transparent transfer of octet-aligned NS-user-data and/or control information. It does not restrict the content, format or coding of the information, nor does it ever need to interpret its structure or meaning.

d) *Quality of service selection*– The Network Service makes available to NS users a means to request and to agree to the quality of service for the transfer of NS-user-data. Quality of service is specified by means of QOS-parameters representing characteristics such as throughput, transit delay, accuracy, and reliability.

e) *NS-user-addressing* – The Network Service utilizes a system of addressing (NSAP addressing) which allows NS users to refer unambiguously to one another.

7 Types and classes of Network Service

There are two types of Network Service:

a) a connection-mode service (defined in clause 2); and

b) a connectionless-mode service (defined in clause 3).

For a given instance of communication, the mode of service provided to both NS users is the same (i.e. connection-mode or connectionless-mode). Choice of provision of the connectionless-mode Network Service or the connection-mode Network Service is made in accordance with ISO 7498/Add.1.

When referring to this Service Definition, an NS user or NS provider shall state which types(s) of service it expects to use or provide.

There are no distinct classes of Network Service defined.

However, for the connection-mode service, two Network Layer Services, Receipt Confirmation and Expedited Data Transfer, are NS provider-options.

A service which is an NS provider-option is one which an NS provider can choose either to provide or not to provide for a particular NC. In circumstances where the NS provider chooses not to provide a provider-option service, it will not be available in the Network Service. If the provider-option Receipt Confirmation or Expedited Data Transfer is provided, it shall be as defined in 14.1 to 14.3.

SECTION 2 – DEFINITION OF THE CONNECTION-MODE SERVICE

8 Features of the connection-mode Network Service

The connection-mode Network Service offers the following features to an NS user:

a) the means to establish an NC with another NS user for the purpose of transferring NS-user-data in the form of NSDUs. More than one NC may exist between the same pair of NS users;

b) the establishment of an agreement between the two NS users and the NS provider for a certain QOS associated with each NC;

c) the means of transferring NSDUs in sequence on an NC. The transfer of NSDUs, which consist of an integer number of octets, is transparent, in that the boundaries of NSDUs and the contents of NSDUs are preserved unchanged by the Network Service, and there are no constraints on the NSDU content imposed by the Network Service;

d) the means by which the receiving NS user may flow control the rate at which the sending NS user may send NSDUs;

e) in some circumstances, the means of transferring separate expedited NSDUs in sequence (see clause 7). Expedited NSDUs are limited in length and their transmission is subject to a different flow control from normal data across the NSAP;

f) the means by which the NC can be returned to a defined state and the activities of the two NS users synchronized by use of a reset service;

g) in some circumstances, the means for the NS user to confirm the receipt of an NSDU (see clause 7);

h) the unconditional, and therefore possibly destructive, release of an NC by either of the NS users or by the NS provider.

9 Model of the connection-mode Network Service

9.1 Model of the connection-mode Network Layer Service

This Service Definition uses the abstract model for a layer service defined in clause 4 of CCITT Rec. X.210 | ISO/TR 8509. The model defines the interactions between the NS users and the NS provider which take place at the two NSAPs. Information is passed between the NS user and the NS provider by service primitives, which may convey parameters.

9.2 Model of a Network Connection

Between the two endpoints of an NC, there exists a flow control function which relates the behaviour of the NS user at one end receiving NS-user-data to the ability of the NS user at the other end to send NS-user-data. As a means of specifying this flow control feature and its relationship with other capabilities provided by the Network Service, the queue model of an NC, described in the following subclauses, is used.

This queue model of an NC is discussed only to aid in the understanding of the end-to-end service features perceived by users of the Network Service. It is not intended to serve as a substitute for a precise, formal description of the Network Service, nor as a complete specification of all allowable sequences of NS primitives, (Allowable primitive sequences are specified in clause 11 – also, see Note below.) In addition, this model does not attempt to describe all the functions or operations of Network Layer entities (including relay entities) which are used to provide the Network Service. No attempt to specify or constrain Network Service implementations is implied.

In interpreting this service definition, statements in clauses 12 to 14 concerning the properties of individual primitives have precedence over the general statements in this clause.

NOTE – In addition to the interaction between service primitives described by this model, there may be constraints applied locally on the ability to invoke primitives, as well as service procedures defining particular sequencing constraints on some primitives.