Network Working Group   ISO
Request for Comments: 941   April 1985

Addendum to the Network Service Definition Covering Network Layer Addressing

ISO/DP8348/DAD2
(also TC 97/SC 6/N 3444)

Status of this RFC:

This document is distributed as an RFC for information only. It does not specify a standard for the ARPA-Internet. Distribution of this document is unlimited.

Note:

This document has been prepared by retyping the text of ISO/DP8348/DAD2 of October 1984 (also numbered SC 6/N 3444), which is currently undergoing voting within ISO as a Draft Proposed Addendum to the Network Service Definition. Although this RFC has been reviewed after typing, and is believed to be substantially correct, it is possible that typographic errors not present in the ISO document have been overlooked.

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ISO Statement on the Status of this Document.

At its meeting in Zurich, April 2-11, 1984, SC 6/WG 2 produced document SC 6 N 3134 and, in accordance with Resolution 49 of the SC 6 meeting in Tianjin (September 19-30, 1983), forwarded it to the SC 6 Secretariat for registration and ballot as a first Draft Proposed Addendum to the Network Service Definition (ISO DP 8348/DAD2).

The letter ballot on SC 6/N 3134 closed on August 20, 1984. The results of the ballot were 10-4-0-3 [approve-disapprove-abstain-no vote]; the summary of voting is contained in document SC 6/N 3229 (late votes are contained in documents SC 6/N 3333 and 3360). These ballot results were reviewed at the SC 6/WG 2 meeting in Washington, October 15-25, 1984, and document SC 6/N 3444 was produced as a progression of SC 6/N 3134, taking into account as many of the ballot comments as possible. The Editor’s report, contained in document SC 6/N 3445, describes the disposition of member body comments on the DP 8348/DAD2 letter ballot.

A resolution of the SC 6 meeting in Washington, October 22-26, 1984, instructs the SC 6 Secretariat to register document SC 6/N 3444 as a second Draft Proposed Addendum to ISO 8348, and to circulate it for a two-month letter ballot.

Introduction

This Addendum to the Network Service Definition Standard, ISO 8348, defines the abstract syntax and semantics of the Network Address (Network Service Access Point Address). The Network Address defined in this Addendum is the address that appears in the primitives of the connection-mode Network Service as the calling address, called address, and responding address parameters, and in the primitives of the connectionless-mode Network Service as the source address and destination address parameters.

SCOPE AND FIELD OF APPLICATION

The scope of this Addendum is the definition of the abstract syntax and semantics of the Network Address. This Addendum does not specify the way in which the semantics of the NSAP address are encoded in Network Layer protocols. The field of application of this Addendum is the same as the field of application described in Clause 1 of the Network Service Definition (ISO 8348).

2 REFERENCES

ISO 7498	Information Processing Systems - Open Systems Interconnection - Basic Reference Model [Note: See also CCITT Recommendation X.200]
DP 7498/DAD1	Information Processing Systems - Open Systems Interconnection - Addendum to the Basic Reference Model Covering Connectionless Data Transmission
DP 8509	Information Processing Systems - Open Systems Interconnection - Service Conventions
ISO 8348	Information Processing Systems - Data Communications - Network Service Definition [Note: See also CCITT Recommendation X.213]
DIS 8348/DAD1	Information Processing Systems - Data Communications - Addendum to the Network Service Definition Covering Connectionless Data Transmission
DP 8648	Information Processing Systems - Data Communications - Internal Organization of the Network Layer
ISO 6523	Data Interchange - Structure for the Identification of Organizations
ISO 646	7-bit Coded Character Set for Information Processing Interchange
ISO 2375	Procedure for the Registration of Escape Sequences
CCITT X.121	International Numbering Plan for Public Data Networks
CCITT E.163	Numbering Plan for the International Telephone Service
CCITT E.164	The Numbering Plan for the ISDN Era
CCITT F.69	Plan for Telex Destination Codes

Temporary Note

The list of References in the published Addendum will contain only approved ISO Standards and CCITT Recommendations; items may need to be subtracted from, or added to, the current list.

SECTION ONE - GENERAL

3 DEFINITIONS

3.1 Reference Model Definitions

This Addendum makes use of the following terms defined in ISO 7498:

a) Network layer

b) Network service

c) Network service access point

d) Network service access point address

e) Network entity

f) Routing

g) Network address

h) Network protocol control information

i) Network protocol data unit

3.2 Service Conventions Definitions

This Addendum makes use of the following terms defined in ISO 8509:

j) Service user

k) Service provider

3.3 Network Layer Architecture Definitions

This Addendum makes use of the following terms defined in ISO 8648 (Internal Organization of the Network Layer):

l) Subnetwork

m) Real subnetwork

n) Subnetwork service

o) Real end system

p) Interworking unit

q) Intermediate system

3.4 Network Addressing Definitions

This Addendum makes use of the following terms as defined below:

r) DTE address: information used to identify a point of attachment to a public data network.

s) 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.

t) Subnetwork address (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 point at which the subnetwork service is offered within an end or intermediate system.

u) Network protocol address information: information encoded in a network protocol data unit to carry the semantics of an NSAP address. (This is known as an "address signal" or as the "coding of an address signal" in the Public Data Network environment.)

v) Domain (of the OSI environment): a subset of the OSI environment within which identifiers for OSI environment entities of the same type are unambiguous.

w) Global network addressing domain: the set of all Network Service Access Point addresses in the OSI environment.

x) Network addressing subdomain; a subset of the global network addressing domain.

y) Authority (for a domain or subdomain): that which ensures that identifiers within the corresponding domain or subdomain are unambiguous.

4 ABBREVIATIONS

This Addendum makes use of the following abbreviations:

a) NSAP - Network Service Access Point

b) NPAI - Network Protocol Addressing Information

c) DCC - Data Country Code

d) CC - Country Code

e) ICD - International Code Designator

f) PSTN - Public Switched Telephone Network

g) ISDN - Integrated Services Digital Network

h) IDP - Initial Domain Part

i) AFI - Authority and Format Identifier

j) IDI - Initial Domain Identifier

k) DSP - Domain Specific Part

l) NPDU - Network Protocol Data Unit

m) SNPA - Subnetwork Point of Attachment

5 CONVENTIONS

No particular standard conventions are invoked by this Addendum.

SECTION TWO - NETWORK LAYER ADDRESSING

6 CONCEPTS AND TERMINOLOGY FOR NETWORK LAYER ADDRESSING

6.1 Network Addresses

This Addendum defines the Network Service Access Point (NSAP) address. Since the term "network address" is commonly used in different contexts to refer to different things a more specific description of this concept is introduced below.

6.1.1 Subnetwork Address

In one context, the term "network address" may be used to refer to the point at which a real end system, real subnetwork, or interworking unit is attached to a real subnetwork, or to the point at which the subnetwork service is offered within an end or intermediate system. In the case of attachment to a public data network, this point is called a DTE/DCE interface, and the term "DTE address" is used in reference to it.

The specific term "subnetwork address" (or "subnetwork point of attachment address") is used in this case, as illustrated in Figure 6-1:

```
                                         subnetwork point of
                                         attachment identified
                                         ________ by SNPA
________________                         |      | /\
|              |                         |______|/  \_______
|   Real End   |    ____________   Layer |  * <-/   |\-> * | Layer
| system, real |    |          |     3   |______|   |______|    3
|subnetwork, or|____|  Real    |         |      |   |      |
| interworking |    |Subnetwork|         |      |   |      |
|     unit     | ^  |__________|         |______|   |______|
|______________| |
                 |
         subnetwork point of               End    Intermediate
        attachment identified            System      System
        by subnetwork address
```

Figure 6-1 - Subnetwork Address

The subnetwork address is the information that a real subnetwork needs to identify a particular real end system, another real subnetwork, or interworking unit that is attached to that real subnetwork.

In the public network environment, the subnetwork address is what the public network operates on.

Note: The point identified by a subnetwork address is a point of interconnection between a real end system or interworking unit and a real subnetwork (in particular, in a public data network environment, a DTE/DCE interface), and is not an OSI Service Access Point.

6.1.2 NSAP address

In another context, the term "network address" is used to refer to the Network Service Access Point (NSAP) at which the OSI Network Service is made available to a Network Service user by the Network Service provider.

The specific term "NSAP address" is used in this case, as illustrated in Figure 6-2:

```
                       Network Service User

layer 4
______________________________  0  _____________________________
                                 \
layer 3                           \____NSAP identified
                                       by NSAP address

                     Network Service Provider
```

Figure 6-2 - NSAP Address

The NSAP address is the information that the OSI Network Service provider needs to identify a particular Network Service Access Point. The values of the called address, calling address, and responding address parameters in the N-CONNECT primitive, of the responding address parameter in the N_DISCONNECT primitive, and of the source address and destination address parameters in the N-UNIDATA primitive, are NSAP addresses.

Note that since the Network Service primitives are conceptual, no particular encoding of the NSAP address is specified by the Network Service Definition.

In both CCITT and ISO usage, the terms "Network Address" (with both the N and the A printed in capital letters) and "global network address" are synonymous with the term "NSAP address". Use of the term

"NSAP address" is preferred when it is essential to avoid confusion, particularly in spoken references where "capitalization" is not possible.

6.1.3 Network Protocol Address Information

In a third context, the term "network address" is used to refer to an address that is carried as network protocol control information in a network protocol data unit (NPDU).

The specific term "network protocol address information" (NPAI) is used in this case.

In the public network environment, NPAI is also known as an "address signal" or as the "coding of an address signal".

There is a relationship between the NSAP address that appears in Network Service primitives and the NPAI that appears in a Network Layer protocol, in that the semantics of the NSAP address is preserved by the NPAI. The syntax and encoding of NPAI are defined by Network layer Protocol standards, which also specify the relationship between the NSAP address and the NPAI encoding employed by the protocol.

6.2 Domains

A domain is a subset of the Open Systems Interconnection environment within which identifiers for OSI environment entities of the same type are unambiguous.

6.2.1 Global Network Addressing Domain

The global network addressing domain is defined as the set of all Network Service Access Point addresses in the OSI environment.

6.2.2 Network Addressing Subdomain

A network addressing subdomain is a set of Network Service access Point addresses. It is a subset of the global network addressing domain.

The relationship of the concepts of 6.2.1 and 6.2.2 is illustrated by Figure 6-3:

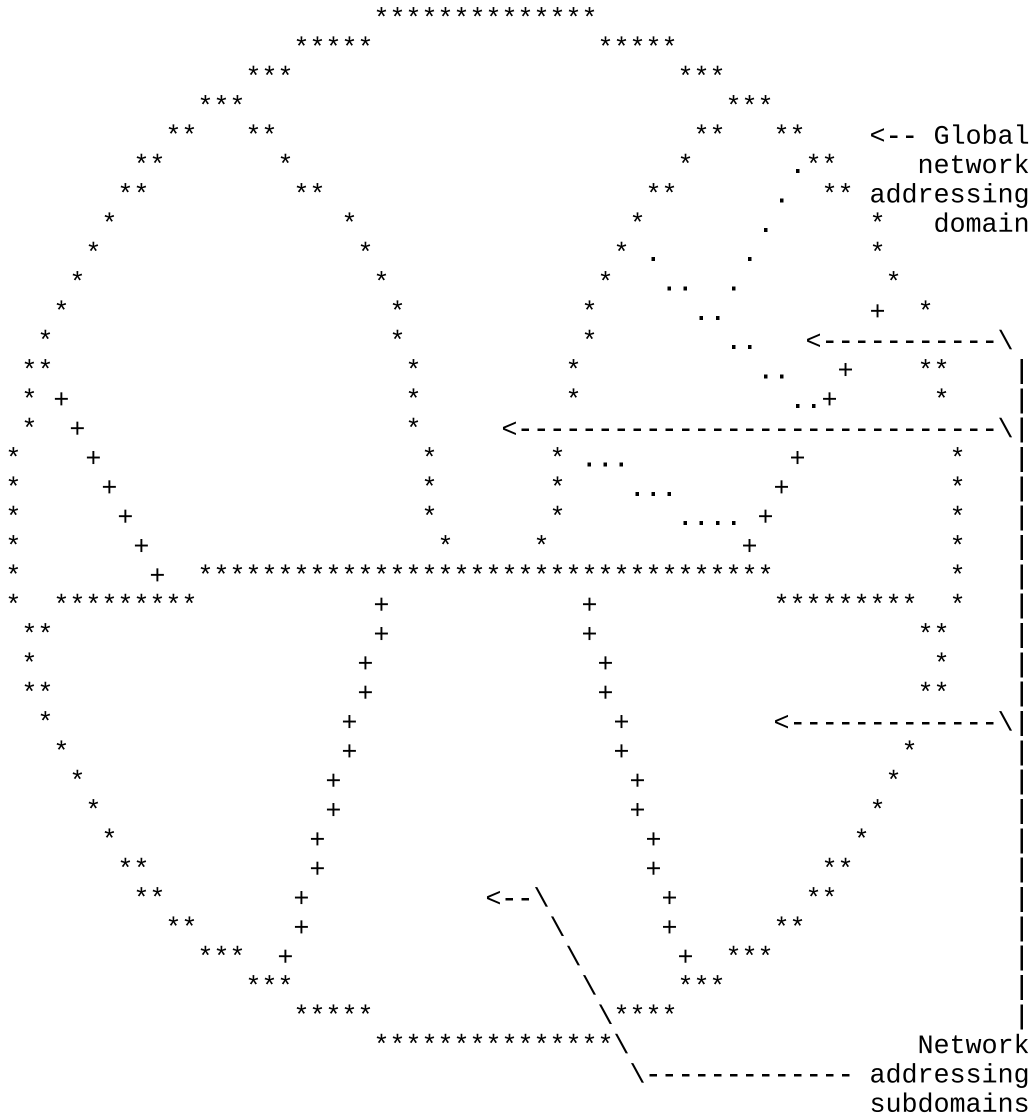

Figure 6-3 - Domains and Subdomains

6.3 Authorities

The uniqueness of identifiers within a domain or subdomain is ensured by an authority associated with that domain. The term "authority" does not necessarily refer to an organization or administration: it is intended to refer to whatever it is (in an abstract sense) that ensures the uniqueness of identifiers in the associated domain.

Domains are characterized by the authority that administers the domain and by the rules that are established by that authority for specifying identifiers and identifying subdomains. The authority responsible for each subdomain determines how identifiers will be assigned and interpreted within that subdomain, and how any further subdomains will be created.

The operation of an authority is independent of that of other authorities on the same level of the hierarchy, subject only to any common rules imposed by the parent authority.

6.4 Network Address Allocation

An addressing authority shall either allocate complete NSAP addresses, or shall authorize one or more other authorities to allocate address. Each address allocated by an addressing authority shall include a domain identifier which identifies the allocating authority. An address shall not be allocated to identify a domain or NSAP if the address has previously been allocated to some other domain or NSAP, unless the authority can ensure that all use of the previous allocation has ceased.

The authority shall ensure that allocations are made in such a way that efficient use is made of the address space.

7 PRINCIPLES FOR CREATING THE OSI NETWORK ADDRESSING SCHEME

7.1 Hierarchical Structure of NSAP Addresses

NSAP addresses are based on the concept of hierarchical addressing domains, as explained in Clause 6. Each domain may be further partitioned into subdomains. Accordingly, NSAP addresses have a hierarchical structure.

The conceptual structure of NSAP addresses follows the principle that, at any level of the hierarchy, an initial part of the address unambiguously identifies a subdomain, and the rest is allocated by the management of the subdomain to unambiguously identify either a lower level subdomain or an NSAP within the subdomain. The part of the address that identifies the subdomain depends on the level at which the address is viewed.

Note: This conceptual structure should not be considered as implying any detailed administration of NSAP addresses.

Graphical representation of the hierarchical structure of NSAP addresses may be made according to an inverted tree diagram, as in Figure 7-1 (a), or a domain diagram, as in Figure 7-1 (b)

```
                                     O
                                     |
                                     |
                     -------------------------------
                     |           |        |        |
                     |           |        |        |
                   -----       -----    -----    -----
                   | W |       | X |    | Y |    | Z |
                   -----       -----    -----    -----
                     |           |        |
                     |           |        |
              ---------------    @    --------
              |      |      |         |      |
              |      |      |         |      |
            -----  -----  -----     -----  -----
            | a |  | b |  | c |     | a |  | b |
            -----  -----  -----     -----  -----
                                             |
                                             |
                                   ----------------------
                                   |      |      |      |
                                   |      |      |      |
                                 -----  -----  -----  -----
                                 | p |  | q |  | r |  | s |
                                 -----  -----  -----  -----
```

Figure 7-1 (a) - Hierarchical Structure of NSAP Addresses
Inverted Tree Diagram

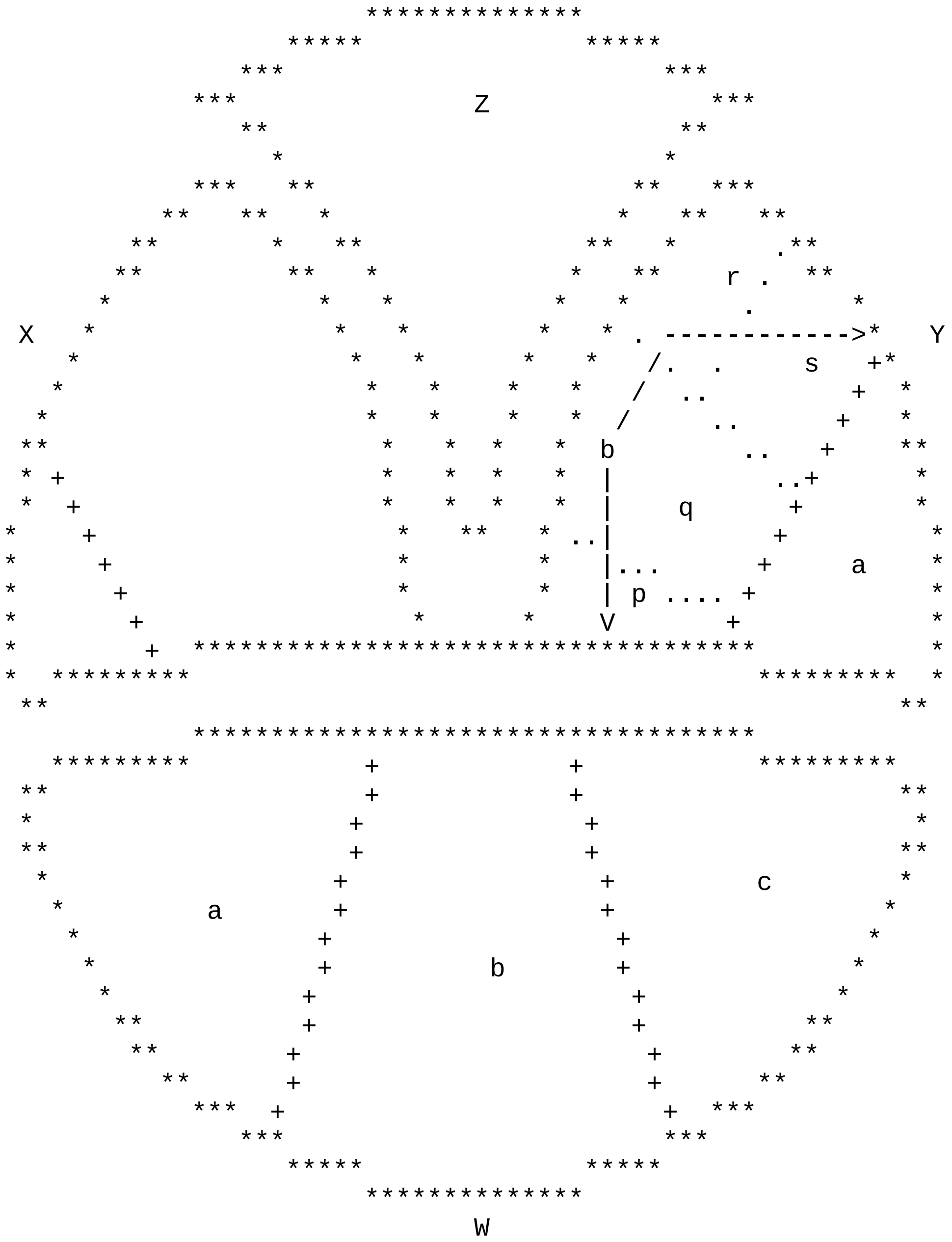

Figure 7-1 (b) - Hierarchical Structure of NSAP Addresses
Domain Diagram

7.2 Global Identification of any NSAP

In the context of Open Systems Interconnection, it is possible to identify any NSAP within the global network addressing domain (see Clause 6.2.1). Consequently,

a) At any Network Service Access Point, it is possible to identify any other Network Service Access Point, within any OSI end system;

b) A global Network Address can therefore be defined to unambiguously identify any Network Service Access Point;

c) The OSI protocols established between correspondent Network entities convey the complete information contained in a Network Address (see Clause 6.1.4);

d) An NSAP address identifies the same NSAP regardless of which NS-user enunciated the address; and

e) An NS-user, when given an NSAP address of the NS-provider in a primitive Indication, may subsequently use that NSAP address in another instance of communication with the corresponding NSAP.

Some restrictions may be placed on communications in the context of OSI, on the basis of: technical feasibility of an interconnection, security, charging, etc. Such considerations are not related to Network Layer addressing, and therefore are not discussed in this Addendum.

Note: The global identification of NSAPs should not be taken to imply the universal availability of directory functions required to enable communication among all NSAPs to which NSAP addresses have been allocated.

7.3 Route Independence

Network Service users cannot derive routing information from an NSAP address. They cannot influence the Network Service provider's choice of route by means of the source and destination NSAP addresses. Similarly, they cannot deduce from the source and destination NSAP addresses the route that was used by the Network Service provider. This is not intended to exclude the possibility that an OSI end system may need to influence the route selected for a particular instance of communication with another OSI end system. (In particular, it may need to influence the selection of intermediate systems to be used, and the paths to be taken between them.) The means whereby such an influence may be exerted is, however, not the NSAP address. Elements of Network Layer protocol may be required to control routing within intermediate systems; such elements of protocol are distinct from the network protocol address information (NPAI).

Notwithstanding the restrictions imposed on the use that a Network

Service user may make of an NSAP address, it is recognized that NSAP addresses should be constructed in such a way that routing through interconnected subnetworks is facilitated. That is, the Network Service provider and relay-entities in particular, may take advantage of the address structure to achieve economical processing of routing aspects.

7.4 Service Type Independence

It may be necessary for Network Service users to distinguish Network Layer services of different types (such as point-to-point versus multipoint services, and connection-mode versus connectionless-mode services). The nature of such service types is not explicitly contained in the semantics of the NSAP address. Similarly, Network Layer quality of service characteristics (such as throughput, transit delay, etc.) are not explicitly specified by the NSAP address.

8 NETWORK ADDRESS DEFINITION

The intent of this document is best served by maintaining clear distinctions among three concepts: the abstract semantics of the NSAP address; the abstract syntax employed in this document as a means of defining the abstract semantics of the NSAP address, and employed by addressing authorities as a means of allocating and assigning addresses; and the concrete syntax in which the NSAP address semantics are encoded as NPAI in Network Layer protocols. These distinctions are illustrated in Figure 8-1:

```
NSAP Address Semantics------->Allocation by------->Abstract Syntax
                         |
                         |
                         |-->Representation in--->External
                         |   Humanly-readable     Reference
                         |   Directories          Syntax
                         |
                         |-->Encoding in--------->Concrete Syntax
                             Protocols
```

Figure 8-1 - Relationship of NSAP Address Semantics and Syntax

This Addendum does not specify the way in which the semantics of the NSAP address are encoded in Network Layer protocols. Network Layer protocol specifications define the way in which the NSAP address is encoded as NPAI (see clause 6.1.4).

8.1 Network Address Semantics

The NSAP address consists of two basic semantic parts. The first part is the Initial Domain Part (IDP). The second part is the Domain Specific Part (DSP). This is illustrated by Figure 8-2.

Following the conceptual structure of NSAP addresses described in Clause 7.1, the IDP is a subdomain identifier: it specifies the subdomain of the global network addressing domain (see Figure 7-1), and identifies the authorities responsible for assigning addresses in each of the subdomains created. The DSP is the corresponding subdomain address. A further substructure of the DSP may or may not be defined by the authority identified by the IDP.

8.1.1 The IDP

The Initial Domain Part of the NSAP address itself consists of two parts. The first part is the Authority and Format Identifier (AFI). The second part is the Initial Domain Identifier (IDI). This is illustrated by Figure 8-2:

```
    <----------------------NSAP ADDRESS------------------------->
     ___________________________________________________________
    |           |                                               |
    |    IDP    |                  DSP                          |
    |___________|_______________________________________________|
                :
                :_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
                                                                :
     ___________________________________________________________:
    |           |                                               |
    |    AFI    |                  IDI                          |
    |___________|_______________________________________________|
```

Figure 8-2 - NSAP Address Structure

8.1.1.1 The AFI

The Authority and Format Identifier specifies:

a) the format of the IDI (see clause 8.2.1.2);

b) the authority responsible for allocating values of the IDI (see clause 8.2.1.2) and

c) the abstract syntax of the DSP (see clauses 8.2 and 8.2.3).

8.1.1.2 The IDI

The Initial Domain Identifier specifies:

a) the Network Addressing subdomain from which values of the DSP are allocated; and

b) the authority responsible for allocating values of the DSP from that subdomain.

8.1.2 The DSP

The semantics of the DSP is determined by the authority identified by the IDI (see clause 8.1.1.2).

8.2 Network Address Abstract Syntax

The Network Address is defined in this Addendum in terms of an abstract syntax which expresses the semantics of the Network Address. The use of this abstract syntax as a descriptive device enables this Addendum to convey, in written form, a complete definition of the Network Address without restricting it to the specific encoding of the NPAI. It also enables this Addendum to identify two alternative preferred concrete synataxes of the Network Address, to which reference may be made by Network Layer protocol specification standards so as to unambiguously define the way in which the Network Address is encoded as NPAI.

8.2.1 Abstract Syntax and Allocation of the IDP

This clause defines the abstract syntax of the AFI, the currently allocated values of the AFI, and the IDI formats corresponding to the allocated AFI values. Among the currently allocated values of the AFIsare values reserved for assignment to new IDI formats which may be identified by ISO or CCITT. Assignment of these AFI values to new IDI formats by either ISO or CCITT must be accompanied by appropriate modification of this Addendum according to the rules established by ISO for revising International Standards. Allocation of new AFI values will be by joint agreement between ISO and CCITT, and will require an appropriate modification of this Addendum.

The abstract syntax of the IDP is decimal digits. The allocation of the AFI (see Clause 8.1.1) ensures that the first decimal digit of the IDP can never be zero. This provides a escape mechanism for use by protocols that expect to hold incomplete NSAP addresses in a field that normally carries a complete NSAP address. When the NSAP address is represented as binary octets, the representation of the IDP is as defined in Clause 8.3.1.

The length of the IDP depends on the IDI format specified by the value of the AFI. The IDP length associated with each IDI format is given in clause 8.2.1.2.

8.2.1.1 Abstract Syntax and Allocation of the AFI

The AFI consists of an integer with a value between 0 and 99 with an abstract syntax of two decimal digits. The values of the AFI are allocated or reserved as shown in Table 8-1:

Table 8-1: AFI ALLOCATIONS

00-09	Reserved - will not be allocated
10-35	Reserved for future allocation by joint agreement of ISO and CCITT
36-51	Allocated and assigned to the IDI formats defined in clause 8.2.1.2
52-59	Reserved for future allocation by joint agreement of ISO and CCITT
60-69	Allocated for assignment to new IDI formats by ISO
70-79	Allocated for assignment to new IDI formats by CCITT
80-99	Reserved for future allocation by joint agreement of ISO and CCITT

8.2.1.2 Format and Allocation of the IDI

A specific combination of IDI format and DSP abstract syntax is associated with each allocated AFI value, as summarized in Table 8-2:

Table 8-2: AFI Values

	DSP Syntax			
IDI format	Decimal	Binary	Character (ISO 646)	National Character
X.121	36	37		
ISO DCC	38	39		
F.69	40	41		
E.163	42	43		
E.164	44	45		
ISO 6523-ICD	46	47		
Local	48	49	50	51

The IDI formats are defined as follows:

a) X.121

The IDI consists of a sequence of up to 14 digits allocated according to CCITT Recommendation X.121. The X.121 number identifies an authority responsible for allocating and assigning values of the DSP.

IDP length: Up to 16 digits.

b) ISO DCC

The IDI consists of a three-digit Data Country Code (DCC). ISO DCC values are allocated by ISO and assigned to ISO member countries or appropriately sponsored non-member countries or authorities. The values of the ISO DCC are a subset of the DCC values allocated by

CCITT in Recommendation X.121 to countries or geographical areas. The DSP is allocated and assigned by the organization that represents the country identified by the DCC.

IDP length: 5 digits.

c) F.69

The IDI consists of a telex number of up to 8 digits, allocated according to CCITT Recommendation F.69, commencing with a 2- or 3-digit destination code. The telex number identifies an authority responsible for allocating and assigning values of the DSP.

IDP length: Up to 10 digits.

d) E.163

The IDI consists of a public switched telephone network (PSTN) number of up to 12 digits allocated according to CCITT Recommendation E.163, commencing with the PSTN country code. The PSTN number identifies an authority responsible for allocating and assigning values of the DSP.

IDP length: Up to 14 digits.

e) E.164

The IDI consists of an ISDN number of up to 15 digits allocated according to CCITT Recommendation E.164, commencing with the ISDN country code. The ISDN number identifies an authority responsible for allocating and assigning values of the DSP.

IDP length: Up to 17 digits

f) ISO 6523-ICD

The IDI consists of a 4-digit International Code Designator (ICD) allocated according to ISO 6523. The ICD identifies an organizational authority responsible for allocating and assigning values of the DSP. The "structure of the code" required by ISO 6523, clause 6.3(d), shall be registered as "According to ISO 8348 Addendum 2".

IDP length: 6 digits.

g) LOCAL

The IDI is null.

IDP length: 2 digits.

Note 1:

In cases (a), (c), (d), and (e) above, when the IDP is followed by a decimal-syntax DSP, no discernible boundary is identified in this Addendum between the IDP digits and the DSP digits.

Note 2:

A figure illustrating the division of the global network addressing domain according to these formats is contained in Annex B.

Note 3:

The use of a particular IDI format as the basis for allocating an NSAP address does not constrain routing to that NSAP to go through any particular subnetwork. For example, the use of the E.163 IDI format as the basis for allocating an NSAP address does not mean that access to the NSAP necessarily involves use of the telephony subnetwork (see clause 7.3).

Note 4:

Formats a, c, d, and e are based on specific CCITT numbering plans, and as such may be affected by any changes to those plans. It should be understood that in identifying and describing these formats, this Addendum observes the current status of CCITT work on numbering plans, and does not establish any preference or position whatsoever concerning the way in which CCITT may choose to modify the plans, or their relationships with one another, in the future. Changes to this may be necessary to take any such further work by CCITT into account. For example, the CCITT numbering plans in some cases may provide escape mechanisms (such as a zero, 8, or 9 prefix) from one numbering plan to another. This results in the possibility of a choice that must be made concerning which of formats a, c, d, and e should be used for the allocation of NSAP addresses, and may also lead to suggestions that it is not necessary to include all of the formats a, c, d, and e in this Addendum. Such choices, however, are made within the context and responsibility of CCITT, and no preference for one choice or another is made or implied by this Addendum.

8.2.2 Abstract Syntax and Allocation of the DSP

Values of the DSP are allocated by the authority identified by the IDI in the syntax identified by the AFI (see clauses 8.1.1.2 and 8.2.1.2).

The allocating authority specifies the format and semantics of the DSP. If the authority identified by the IDI authorizes one or more authorities to allocate semantic parts of the DSP, then all those authorities must allocate using the same abstract syntax used by the parent authority.

An authority may choose to allocate NSAP addresses with the DSP in a decimal or binary abstract syntax for all IDI formats, and may choose to allocate NSAP addresses with the DSP in a character (ISO 646) or National Character abstract syntax when the IDI format is "Local" (see Table 8-2). Clause 9 describes the latter case in detail.

8.2.3 Abstract Syntax of the DSP

The DSP may be allocated by the responsible authority in one of four syntaxes, depending on the value of the AFI:

a) Binary: The DSP consists of zero or more binary octets, up to the maximum specified in Table 8-3.

b) Decimal: The DSP consists of zero or more decimal digits, up to the maximum specified in Table 8-3.

c) Character: The DSP consists of zero or more of those graphic, characters with no national variant, plus the space character, from ISO 646, up to the maximum specified in Table 8-3.

d) National Character: The DSP consists of zero or more characters from a character set determined by the allocating authority, up to the maximum specified in Table 8-3.

Table 8-3 gives the maximum length of the DSP in its abstract syntax for each of the IDI formats defined in clause 8.2.1.2. The corresponding total NSAP address lengths are given in clause 8.4.

8.3 Network Address Concrete Syntax

As describe in Clause 8.1, the semantics of the NSAP address consists of three fields in the following order:

a) the AFI, with an abstract syntax of two decimal digits;

b) the IDI, with an abstract syntax of a variable number of decimal digits; and

Table 8-3: Maximum DSP Length

IDI format	DSP Syntax			
	Decimal	Binary	Character (ISO 646)	National Character
X.121	24	9		
ISO DCC	35	14		
F.69	30	12		
E.163	26	10		
E.164	23	9		
ISO 6523-ICD	34	13		
Local	38	15	19	7

c) the DSP, with an abstract syntax of a variable number of one and only one of the following types: binary octets, decimal digits, characters, or national characters.

This Addendum does not specify the way in which the semantics of an NSAP address are encoded in Network Layer protocols by a concrete syntax in NPAI (see Note following this clause). These encodings are specified in Network Layer protocol standards.

Note: Encoding implies more than a concrete syntax, such as the order of bit transmission, representation as tones or other signals, etc.

Nevertheless, this Addendum identifies two alternative concrete syntaxes (see clauses 8.3.1 and 8.3.2) of the Network Address. Reference to these may be made by Network Layer protocol specification standards. It is possible that the concrete syntax used to encode the Network Address as NPAI in a Network Layer protocol may be chosen to be identical to one of these concrete syntaxes. It is not required that this be the case, however (see clause 9).

The entire NSAP address taken as a whole may be represented explicitly as a string of either decimal digits (decimal concrete syntax) or binary octets (binary concrete syntax) as defined below. Network Layer protocol specifications making reference to this Addendum shall specify the way in which either the decimal concrete syntax or the binary concrete syntax of the NSAP address (or both) is encoded as NPAI (see clause 6.1.3).

8.3.1 Binary Concrete Syntax

The binary concrete syntax is generated by:

a) using two semi-octets to represent the two digits of the AFI, yielding a value for each semi-octet in the rage 0000-1001;

b) padding the IDI with leading zero digits if necessary to obtain the maximum IDI length (specified for each IDI format in clause 8.2.1.2), then using a semi-octet to represent the value of each decimal digit (including leading padding digits, if preset), yielding a value in the range 0000-1001; and, if the DSP syntax is not decimal digits, using the semi-octet value 1111 as a pad after the final semi-octet (if necessary) to obtain an integral number of octets;

c) representing a decimal syntax DSP using the technique described in (b);

d) representing a binary syntax DSP directly as binary octets;

e) when the IDI format is "Local", representing an ISO 646 character syntax DSP by converting each character to a number in the range 32-127 using the ISO 646 encoding, with zero parity and the parity bit in the most significant position, reducing the value by 32, giving a number in the range 0-95, encoding this result as a pair of decimal digits; and applying the technique described in (b); and

f) when the IDI format is "Local", representing a National Character syntax DSP by converting each national character to either one or two octets according to the rules specified by the authority responsible for allocating NSAP addresses including national character DSP syntaxes.

8.3.2 Decimal Concrete Syntax

The decimal concrete syntax is generated by:

a) representing the two digits of the AFI directly as two decimal digits;

b) padding the IDI with leading zero digits if necessary to obtain the maximum IDI length (specified for each IDI format in Clause 8.2.1.2), representing the result directly as decimal digits;

c) representing a decimal syntax DSP directly as decimal digits;

d) representing a binary syntax DSP as follows:

Taking the octets in pairs, convert each octet of the pair to a number in the range 0-255; this generates six decimal digits, abcdef, of which digits a and d may take on only the values o, 1, or 2. The pair of octets is represented by the sequence of five digits gbcef, where the value of digit g is given in Table 8-4:

Table 8-4: Values of g.

d \ a	0	1	2
0	0	1	2
1	3	4	5
2	6	7	8

If the original binary field contained an odd number of octets, the final octet is converted to a number in the range 0-255 and represented as three decimal digits (000-255);

e) when the IDI format is "Local", representing an ISO 646 character syntax DSP using the technique described in Clause 8.3.1 (e); and

f) when the IDI format is "Local", representing a National Character syntax DSP using the technique described in Clause 8.3.1 (f).

8.4 Maximum Network Address Length

The maximum length of the NSAP address for each of the combinations of IDI abstract syntax is given in Table 8-5 both the decimal concrete syntax and the binary concrete syntax.

Table 8-5: Maximum NSAP Address Lengths

IDI Format	DSP Abstract syntax	Binary DSP concrete syntax	Decimal DSP concrete syntax
X.121	Decimal	20 octets	40 digits
	Binary	17 octets	39 digits
ISO DCC	Decimal	20 octets	40 digits
	Binary	17 octets	40 digits
F.69	Decimal	20 octets	40 digits
	Binary	17 octets	40 digits
E.163	Decimal	20 octets	40 digits
	Binary	17 octets	39 digits
E.164	Decimal	20 octets	40 digits
	Binary	18 octets	40 digits
ISO 6523-ICD	Decimal	20 octets	40 digits
	Binary	16 octets	39 digits
LOCAL	Decimal	20 octets	40 digits
	Binary	16 octets	40 digits
	Character	20 octets	40 digits
	National Char.	15 octets	37 digits

Note: These values assume a National Character representation of one character as two binary octets (see clause 8.2.3).

From this table it is clear that:

a) the maximum length of an NSAP address in its binary concrete syntax is 20 octets; and

b) the maximum length of an NSAP address in its decimal concrete syntax is 40 digits.

A Network Layer protocol which is capable of conveying a string of variable length with a maximum length of either 20 binary octets or 40 decimal digits is capable of encoding the full semantic content of any Network Address.

9 CHARACTER BASED DSP ALLOCATION

An authority may choose to allocate NSAP addresses with the DSP in a National Character syntax. In such cases, the allocating authority must define and publish the mapping of the National Character syntax to either a binary abstract syntax or a decimal abstract syntax.

Note: It is recommended that this mapping be done by reference to the ISO Register of Character Sets, which is maintained by the European Computer Manufacturers Association (ECMA) acting as a registration authority according to ISO 2375, "Procedure for the Registration of Escape Sequences".

In the case where the authority defines and publishes the mapping of the National Character set to a binary abstract syntax, the result must be representable in either one or two octets per National Character. In this case, the resulting DSP is considered to be based on the Binary abstract syntax. AFI values from Table 8-2 and the mapping to binary and decimal concrete syntaxes are based on the binary abstract syntax.

In the case where the authority defines and publishes the mapping of the National Character set to a decimal abstract syntax, the result must be representable in up to five decimal digits per National Character. In this case, the resulting DSP is considered to be based on the decimal abstract syntax. AFI values from Table 8-2 and the mapping to binary and decimal concrete syntaxes are based on the decimal abstract syntax.

Note: The ability to base DSP allocation on National Character sets allows DSP allocation based on international character sets. This may simplify address assignment in some cases, and may facilitate representation of NSAP address in humanly-readable form. Nevertheless, NSAP addresses should not be confused with Application Layer entity titles. NSAP addresses are not intended to provide the same degree of human-readable, user-friendly naming and addressing capabilities as may be expected in Application Layer entity titles.

10 REFERENCE PUBLICATION FORMATS

Reference publication formats are defined to allow unambiguous representation of NSAP addresses in both written and oral communication.

10.1 Decimal Reference Publication Format

The Decimal reference publication form (DRPF) consists of a string of up to 40 decimal digits. The DRPF is the written inscription of the decimal concrete syntax defined in clause 8.3.2.

10.2 Hexadecimal Reference Publication Format

The Hexadecimal reference publication format (HRPF) consists of the symbol "/" (solidus) followed by a string of up to 40 hexadecimal digits. The HRPF is the written inscription of the binary concrete syntax defined in clause 8.3.1, using two hexadecimal digits ranging from 00 through FF to represent each binary octet.

ANNEX A - NETWORK ENTITY TITLES

This Annex is an integral part of the Addendum.

In order to perform routing functions and to distribute Network Layer management information concerning routing among Network entities, it is necessary to be able to unambiguously identify Network entities in end systems and intermediate systems. The Reference Model (ISO 7498) provides a definition of the concept of an (N)-entity title, which may be used to permanently and unambiguously identify a Network entity in an end system or intermediate system.

Any authority responsible for allocating addresses to NSAPs may choose also to allocate Network entity titles. One of the ways in which this can be done is to use the principles and mechanisms defined in this Addendum for allocating Network addresses. When this approach is taken, a Network entity title has the same abstract syntax as an NSAP address. A value may be allocated as a Network entity tile only if it has not been allocated as an NSAP address.

ANNEX B - NSAP ADDRESS ALLOCATION

This Annex is not an integral part of the Addendum.

The division of the global Network addressing domain according to the IDI formats described in clause 8.2.1.2 may be illustrated by the following figure. The numbers adjacent to each line in the figure are AFI values, as defined in Table 8-2 of clause 8.2.1.2.

Figure B-1 - NSAP Address Allocation on attached page.

00-09	Reserved - will not be allocated
10-35	Reserved for future allocation by joint agreement of ISO and CCITT
36-37	X.121
38-39	ISO DCC
40-41	F.69
42-43	E.163
44-45	E.164
46-47	ISO ICD
48-51	Local
52-59	Reserved for future allocation by joint agreement of ISO and CCITT
60-69	Allocated for assignment by ISO
70-79	Allocated for assignment by CCITT
80-99	Reserved for future allocation by joint agreement of ISO and CCITT

ANNEX C - RATIONALES

This annex contains tutorial and explanatory material, and is not an integral part of the Addendum.

C.1 IDI FORMATS (Clause 8.2.1.2)

The rationale for the use of the specific IDI formats identified in Clause 8.2.1.2 is to allow the allocation and assignment of NSAP addresses to be based on existing, well-established network numbering plans and organization-identification standards.

The CCITT numbering plans are included so as to allow for the designation of the organization to which a number is assigned as an authority for the assignment of NSAP addresses. If the organization identified by a particular number from one of these plans chooses not to define any further sub-addressing beyond that number, then the number itself constitutes an NSAP address when it is used in the OSI environment. This flexibility allows number allocated from the four CCITT numbering plans identified in Clause 8.2.1.2 to be used directly as NSAP addresses, with the addition of nothing more than the initial AFI digits that identify the plan.

The ISO DCC format is included so as to allow for the designation, where permitted by national regulations, of the organization that represents a country in ISO (or an appropriately sponsored organization) as an authority for the assignment of geographically-based NSAP addresses. The way in which addresses are allocated and assigned in the ISO DCC format is determined by the designated organization, which might, for example, be the national standards body that represents a country in ISO.

The ISO 6523-ICD format is included so as to allow for the designation, where permitted by national regulations, of an organization that may or may not be tied to a particular country as an authority for the assignment of NSAP addresses according to the hierarchy appropriate for that organization (which may not be based on geographical or national boundaries). The way which addresses are allocated and assigned in the ISO 6523-ICD format is determined by the designated organization, which might, for example, be the United Nations World Health Organization.

The Local format is included so as to allow for proprietary or other non-standard network addressing schemes to coexist with the standard OSI network addressing scheme. Use of the Local format for these non-standard address ensures that they cannot be confused with standard OSI network addresses. This capability will be useful in the evolution of existing networks to OSI, and for the accommodation of non-OSI addressing schemes that may be used in proprietary network architectures or for testing and other interim purposes. It should be emphasized that the Local format is not intended to give non-OSI schemes a permanent place in OSI, but rather to permit the OSI network addressing sheme to be used wherever possible without risk of conflict with other schemes (which can be encapsulated safely under the Local format).

C.2 RESERVATION OF AFI VALUES 00-09 (Table 8-2)

The reservation of AFI values beginning with the digit 0 is intended to allow for the use of an initial 0 to handle special cases, such as:

a) as an escape to some other addressing scheme;

b) as a technique for the optimization of NSAP address encoding in Network Layer protocols, when the different parts of the NSAP address semantics are encoded in different fields of the protocol header;

c) as a way to indicate, in a protocol header, that a field that ordinarily contains a full NSAP address in fact contains something less than a full address (for example, a shorthand form that omits specification of the higher-order domains, which might be used for communication within a particular subdomain environment).

There may be other cases in which the use of an initial 0 digit is found to be useful. This Addendum merely reserves the AFI values 00-09, and does not specify how they might be used; all such uses are outside the scope of this Addendum.

C.3 DERIVATION OF THE CONCRETE SYNTAXES (Clause 8.3)

In describing the two "preferred" concrete syntaxes of the NSAP address, Clauses 8.3.1 and 8.3.2 introduce two types of padding: padding with zero digits at the beginning of an IDI, and padding with a semi-octet with the value 1111 at the end of the binary encoding of an IDI with an odd number of decimal digits.

The first type of padding is necessary because some of the IDI formats allow the IDI to consist of a variable number of digits. Since there is no explicit syntactic marker between the IDI and the DSP, the only way to find the end of the IDI is to know how long it is. The AFI, which identifies which IDI format is used, allows only the maximum length of that IDI to be determined. Rather than introduce either a specific syntactic marker or a new field containing the length of the IDI (either of which would have greatly complicated the encoding and parsing of NSAP addresses), the Addendum specifies that for encoding purposes the IDI must first be padded out to its maximum length. Note that this does not apply to the DSP; only to the IDI.

The second type of padding is necessary to ensure that a binary encoding of the IDI consists of an integral number of binary octets.