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Internet Code Point (ICP) Assignments for NSAP Addresses

Status of This Memo

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Abstract

This document is intended to accomplish two highly inter-related tasks: to establish an "initial" Internet Code Point (ICP) assignment for each of IPv4 and IPv6 address encoding in Network Service Access Point (NSAP) Addresses, and to recommend an IANA assignment policy for currently unassigned ICP values. In the first task, this document is a partial replacement for RFC 1888 -- particularly for section 6 of RFC 1888. In the second task, this document incorporates wording and specifications from ITU-T Recommendation X.213 and further recommends that IANA use the "IETF consensus" assignment policy in making future ICP assignments.

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1. Introduction

Section 6 of RFC 1888 [1888] previously provided for assignment of the initial Internet Code Point (ICP) value '0' for encoding an IPv6 address in a Network Service Access (or Attachment) Point [NSAP] address. RFC 1888 also defined multiple means for restricted encoding of an NSAP address in an IPv6 address.

The means RFC 1888 defined for encoding NSAP addresses in IPv6 address format was heavily annotated with warnings and limitations that apply should this encoding be used. Possibly as a result, these encodings are not used and appear never to have been used in any IPv6 deployment. In addition, section 6 contains minor errors. As a result of these various considerations, RFC 1888 [1888] has been obsoleted and declared Historic by RFC 4048 [4048].

It is the belief of the authors of this document that the errors in section 6 of RFC 1888 resulted -- at least in part -- because the ITU-T specification [X.213] that originally assigned Authority and Format Identifier (AFI) '35' to IANA was not freely publicized, nor was it incorporated or explained using the mechanism commonly used in the IETF, i.e., an RFC.

It is therefore part of the purpose of this document to provide that explanation.

In addition, because there are other documents that refer to the IPv6 ICP assignment in RFC 1888, it is necessary for the errors in section 6 of RFC 1888 to be corrected, irrespective of the RFC's ultimate status.

Finally, no previous RFC (including RFC 1888) has ever formalized an assignment of an IPv4 ICP. This may have been in part because of a lack of formal definition of an IANA assignment policy for ICP values under the IANA-allocated AFI ('35').

This document replaces section 6 of RFC 1888 in defining the ICP for IPv6 address encoding in an NSAP address, and it formalizes the ICP assignment for IPv4 address encoding in an NSAP address.

1.1. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [2119].

1.2. Acronyms and Terminology

AFI - Authority and Format Identifier
BCD - Binary Coded Decimal
DSP - Domain Specific Part
IANA - Internet Assigned Numbers Authority
ICP - Internet Code Point
IDI - Initial Domain Identifier
IDP - Initial Domain Part
IETF - Internet Engineering Task Force
ISO - International Organization for Standardization
NSAP - Network Service Access (or Attachment) Point (often NSAPA)
NSAPA - NSAP Address; 20-Octet Address Format
OSI - Open Systems Interconnection
RFC - Request For Comments
WIP - Work In Progress

2. IANA Considerations

An ITU-T Recommendation [X.213] has allocated two AFIs designating IANA as the assignment authority. One of these two AFIs ('34') is allocated for assignment of NSAPA in Decimal Numeric Format. This document does not address allocation for this AFI as it is not clear what use (if any) can be made of this encoding format at this time. The other AFI ('35') is to be used for binary encoding except as noted below.

The NSAPA format consists of an Initial Domain Part (IDP) and Domain Specific Part (DSP). The IDP, in turn, consists of an Authority and Format Identifier (AFI) and an Initial Domain Identifier (IDI). The AFI is defined to be a binary octet, and the IDI is defined to be a four decimal digit number encoded in two octets using Binary Coded Decimal format. Each nibble of the IDI is used to represent a decimal digit, using binary value '0000' through '1001'.

In assigning allocation authority for AFI '35' to IANA, the ITU-T Recommendation [X.213] specifies that the two-octet IDI will be used to hold an Internet Code Point (ICP) that, because of the decimal encoding, MUST be in the decimal range from '0' to '9999'.

The ITU-T recommendation assumes the assignment of ICP '0' (zero) for IPv6 address encoding in a Network Service Access Point Address (NSAPA, or often NSAP). In addition, ITU-T assumed that IANA would assign an ICP for IPv4 address encoding in an NSAPA and X.213 assumed that the ICP value for this purpose would be '1'.

In an NSAPA, the DSP is the remaining octets after the IDP. For AFI '35', this is 17 octets having a format as defined by IANA or as defined by another party and published with IANA consent.

IANA, as the authority responsible for AFI '35', SHOULD NOT assign an ICP unless there is a corresponding defined, and published, format at the time of the code point assignment.

The IANA has assigned the following ICP values:

ICP Value	Address Encoding	Format Definition
'0'	IPv6	RFC 4548, section 3.2
'1'	IPv4	RFC 4548, section 3.1

Remaining decimal values '2' through '9999' MUST be assigned on an IETF consensus basis [2434].

3. Initial Allocations and Uses

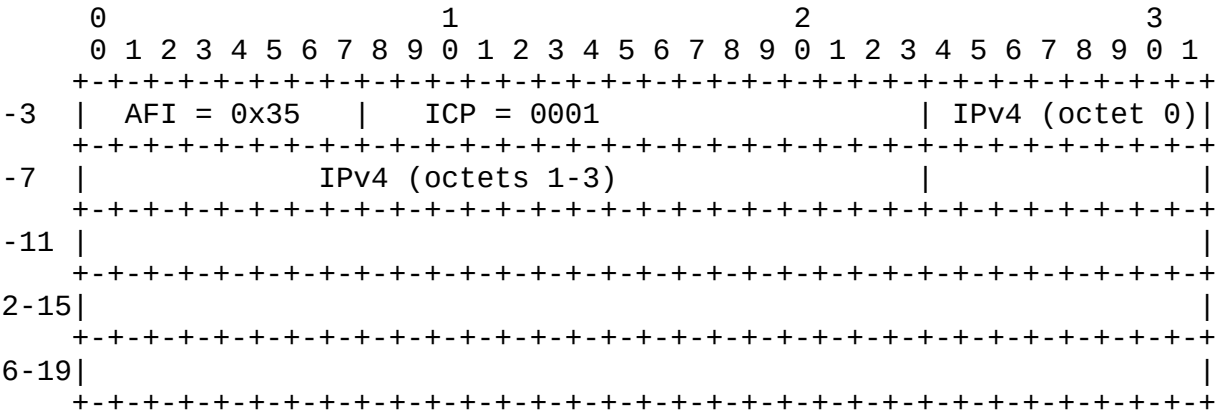
This document continues the ICP assignment and format definition as previously defined in RFC 1888, and it formalizes the allocation of ICP value '1' for IPv4 encoding and the format to be used. The sections below describe the specific IPv4 and IPv6 address encoding formats.

3.1. IPv4 Address Encoding in an NSAPA

If it is required, for whatever reason, to embed an IPv4 address inside a 20-octet NSAP address, then the following format MUST be used. Note: alignment is an artifact of existing NSAPA usage.

A specific possible use of this embedding is to express an IP address within the ATM Forum address format. Another possible use would be to allow Connectionless Network Protocol (CLNP) packets that encapsulate IPv4 packets to be routed in a CLNP network using the IPv4 address architecture. Several leading octets of the IPv4 address could be used as a CLNP routing prefix.

An NSAPA with an AFI value of '35' and an ICP value of '1' (one) encodes a 4-octet IPv4 address in the first 4 octets of the DSP. The last 13 octets of the DSP are unspecified in this document. To maintain compatibility with both NSAP format and IPv4 addressing, these octets MUST be present, but have no intrinsic significance for IPv4. The default values for the unspecified octets is zero.



An NSAPA with the IANA AFI code and ICP set to '1' (one) is converted to an IPv4 address by stripping off the first 3 and the last 13 octets. If the NSAP-addressed contents are passed to a higher layer, the last 13 octets SHOULD be presented to the higher layer as well.

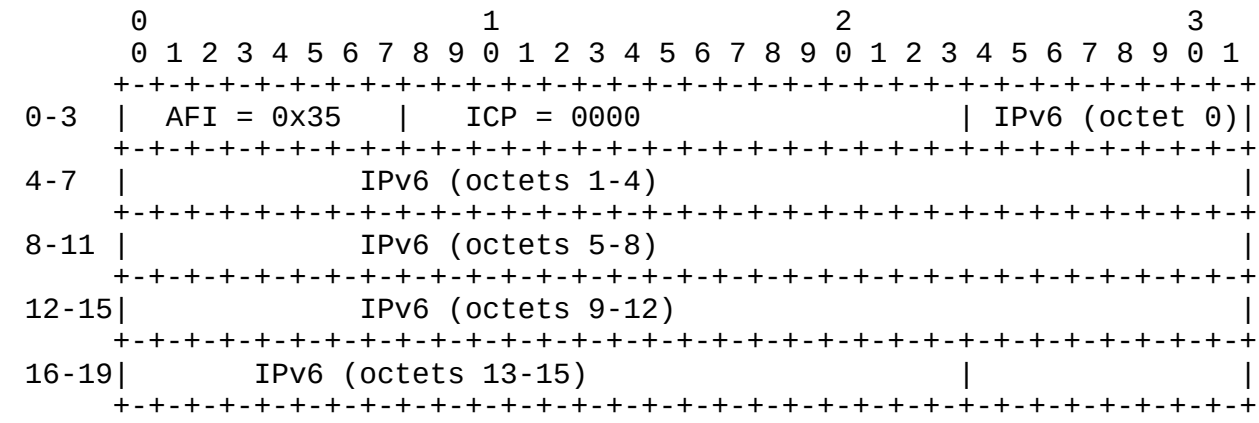
If an NSAP address using this encoding is used for routing in an IPv4 routing architecture, only the 4-octet IPv4 address MAY be considered.

3.2. IPv6 Address Encoding in an NSAPA

If it is required, for whatever reason, to embed an IPv6 address inside a 20-octet NSAP address, then the following format MUST be used. Note: alignment is an artifact of existing NSAPA usage.

A specific possible use of this embedding is to express an IP address within the ATM Forum address format. Another possible use would be to allow CLNP packets that encapsulate IPv6 packets to be routed in a CLNP network using the IPv6 address architecture. Several leading octets of the IPv6 address could be used as a CLNP routing prefix.

An NSAPA with an AFI value of '35' and an ICP value of '0' (zero) encodes a 16-octet IPv6 address in the first 16 octets of the DSP. The last octet of the DSP is a selector. To maintain compatibility with both NSAP format and IPv6 addressing, this octet MUST be present, but it has no intrinsic significance for IPv6. Its default value is zero, but other values may be used as specified for any specific application. For example, this octet may be used to specify one of 255 possible port numbers.



An NSAPA with the IANA AFI code and ICP set to '0' (zero) is converted to an IPv6 address by stripping off the first 3 octets and the 20th octet. If the NSAP-addressed contents are passed to a higher layer, the last octet SHOULD be presented to the higher layer as well.

If an NSAP address using this encoding is used for routing in an IPv6 routing architecture, only the 16-octet IPv6 address MAY be considered.

4. Security Considerations

The NSAP encoding of IPv4 and IPv6 addresses is compatible with the corresponding security mechanisms of RFC 4301 [4301], hence this document introduces no new security exposure in the Internet.

5. References

5.1. Normative References

[4301] Kent, S. and K. Seo, "Security Architecture for the Internet Protocol", RFC 4301, December 2005.

[2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[NSAP] International Organization for Standardization, "Information technology - Open Systems Interconnection - Network service Definition", ISO/IEC 8348:2002, 2002.

[X.213] ITU-T Recommendation X.213, X-Series Recommendations, Data Networks and Open Systems Communications, October, 2001.

[2434] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 2434, October 1998.

5.2. Informative References

[1888] Bound, J., Carpenter, B., Harrington, D., Houldsworth, J., and A. Lloyd, "OSI NSAPs and IPv6", RFC 1888, August 1996.

[4048] Carpenter, B., "RFC 1888 Is Obsolete", RFC 4048, April 2005.

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