Network Working Group
INTERNET–DRAFT

S.E. Kille
University College London
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An interim approach to use of Network Addresses

Status of this Memo

The OSI Directory specifies an encoding of Presentation Address, which utilises OSI Network Addresses as defined in the OSI Network Layer standards [CCI88] [ISO87a]. The OSI Directory, and any OSI application utilising the OSI Directory must be able to deal with these Network Addresses. Currently, most environments cannot cope with them. It is not reasonable or desirable for groups wishing to investigate and use OSI Applications in conjunction with the OSI Directory to have to wait for the lower layers to sort out. This note is a proposal for mechanisms to utilise Network Addresses.

This draft document will be submitted to the RFC editor as a protocol specification. Distribution of this memo is unlimited. Please send comments to the author or to the discussion group <osi-ds@CS.UCL.AC.UK>.

1 Introduction

The OSI Directory specifies an encoding of Presentation Address, which utilises OSI Network Addresses as defined in the OSI Network Layer standards [CCI88] [ISO87a]. The OSI Directory, and any OSI application utilising the OSI Directory must be able to deal with these Network Addresses. Currently, most environments cannot cope with them. It is not reasonable or desirable for groups wishing to investigate and use OSI Applications in conjunction with the OSI Directory to have to wait for the lower layers to sort out. This note is a proposal for mechanisms to utilise Network Addresses. It defines, in Appendix A, some allocated values.
This document must be read in the context of ISO 8348 Addendum 2 [ISO87b]. It will not be meaningful on its own.

2 Historical Note

This document was originally published as UCL Research Note RN/89/13 and as a project THORN internal document [Kil89]. It was devised in response to two projects which faced this requirement, and was agreed as a common approach. The projects were:

- The THORN project, which is an Esprit Project building an OSI Directory [SA88].
- The ISODE project [Ros90], and in particular the QUIPU directory being developed at UCL [Kil88].

The proposal has been implemented, and the viablity of the solution demonstrated.

3 The Problem

When utilising the OSI Directory, the OSI location of an End System will be determined by a Network Address, which is taken from a Presentation Address, looked up in the OSI Directory.
The "real world" of OSI (at least the one the author is in) consists of:

- An international X.25 network, which routes on the basis of X.121 addresses. By and large this is X.25(80), but some parts are now X.25(84) and will carry Network Addresses as user data. OSI Transport is mapped onto the variant of X.25 which is to hand.
- Large private X.25 networks, which do not have DNICs, but are otherwise similar to the previous (in particular Janet).
- Isolated networks running Connection Oriented Network Service (e.g., Pink Book Ethernets).

- Isolated networks running Connectionless Network Service (e.g., MAP LANs).
- Isolated TCP/IP LANs, utilising RFC 1006 to support the OSI Transport Service[RC87].
- The DARPA/NSF Internet, also using RFC 1006.

In general, these systems need to be interconnected by the unfortunate mechanisms of transport bridging — but this is another story. It is hoped that the mechanisms described in this note will reduce the need for Transport Bridging, and make more of these networks behave as subnetworks (OSI Terminology).
Where End Systems do have access to Network Service, there is no general mechanism for Network Address to SNPA binding (local table lookup is the norm)[1].

4 The "Right Solution"

Before diving into ugliness, it is worth noting briefly what the intended solution is. Network Addresses are globally allocated, and do not imply anything about routing or location. An End System is attached to one or more subnetworks at Subnetwork Points of Attachment (SNPAs). Intermediate Systems join subnetworks, again being attached at SNPAs. Routing is achieved by repeated binding of Network Address to SNPA (initially at the Originating End System, and then at each Intermediate System). This binding is achieved by use of a directory service[2].
The rest of this section is a polemic — mainly to make the author feel better. Network Addresses have been designed for general purpose allocation. Whilst this is one important characteristic of a Network Address, others have been entirely neglected. The practicalities of routing and lookup in directory service appear to have been ignored in the design. The issue of building the mechanisms for routing are being discussed as some sort of afterthought. This is sad, and it seems to the author that the network address specification will need to be entirely rewritten before large scale OSI can become a reality[3].

5 The General Approach Proposed

The means of connecting to a remote Application Entity is broadly as follows.

[1] The current ES-IS work does solve some aspects of this, but it is only applicable to CLNS and makes restrictions as to how Network Addresses are structured. These are sensible restrictions, but the mechanism is no longer general purpose.

[2] The OSI Directory is almost certainly inappropriate for this function — a special purpose network directory is needed.

[3] Restrictions on use of network addresses within the ES-IS work may be an initial basis for this rewrite.

1. Look up the Application Entity in the OSI Directory to obtain the Presentation Address [4].
2. Extract each Network Address from the Presentation Address, and determine if it can be used (and how).
3. Determine an order of preference for the Network Addresses.
4. Attempt to connect to one or more of the Network Addresses.

This note is concerned with the second step, and will probably have implications on the third. The following mechanisms for Network Address are discussed in this note:

- X.121 form
- A special encoding for networks which do not provide Network Service.
- Other forms

6 X.121 Form

In principle, the IDP is only an allocation mechanism, and has no routing implications. However, due to the lack of a network directory service, it is recommended that any End System with Connection Oriented Network Service and access to the international X.25 service uses X.121 form relative to its access point. Allocation of DSP (Domain Specific Part) is a private issue.
Conversely it is recommended that if an X.121 IDP (Initial Domain Part) form Network Address is interpreted, then the X.121 address will provide a route (by defining an SNPA on the international X.25 network). There may be additional and perhaps preferable routes which can be determined by private means.
If the DSP is absent, the form should be interpreted as implying a mapping of Transport onto X.25(80).

7 Requirements

The requirements for use of OSI over existing networks not supporting CONS or CLNS, when using the OSI Directory are:

1. The information for the layers below Transport must be obtained from the Network Address. This is essential, because we wish to use the OSI Directory in a standard manner, and the Network Address is the information available.

[4] Strictly an Application Entity should have only one Presentation Address. In practice it may have several, and the network addresses of each Presentation Address should be considered.

2. The Network Addresses must be globally unique, as they can be looked up by anyone with access to the Directory.

3. The Network Address should be allocated so that confusion with a "real" Network Address (i.e., one which defines an NSAP using CONS or CLNS as opposed to X.25(80) or RFC 1006) is minimal.

4. Network Addresses must be interpretable on the basis of a well known information, or on information which can be obtained from the (application level) OSI Directory.

5. The identity of the network in question must be deduceable from the Network Address

6. All network specific addressing information (including the SNPA) must be deducible from the Network Address

8 Proposal

The following approach is proposed.

- A (sub)network is identified by the IDP and a *small* part of the DSP.
- The remainder of the DSP encodes network specific information
- It is suggested that the following IDPs are not used:
  - Local (the values must be globally unique)
  - X.121 (because it will be confused with real Network Addresses)
  - DCC and ICD (because they are very likely to be confused with real Network Addresses)
- It is suggested that a Telex form IDP is used because:
  - It gives the largest DSP
  - It is less likely than other forms to be used for "real" Network Addresses

The scope of the proposed encoding is where:

- The value of the IDP is recognised
- The encoding of the DSP is abstract decimal
- The first two digits of the DSP are recognised

In these cases, the IDP + 2 digit prefix identify a subnetwork in which the value of the DSP is to be interpreted.

9 The DSP Encoding

It is proposed to use a decimal abstract encoding for the DSP. This is a new encoding, as the only alternative on the table (ECMA 117) [TC386], is not entirely suitable. Use of a binary encoding, with the DSP structured in ASN.1 would have been a very attractive approach. However, it appears that there is insufficient space in the Network Address for this to be feasible. The following structure is proposed:

Digit	1-2	3-27
Meaning	Prefix	Network Specific

2 digits Prefix. This allows for multiple usage of the same DSP, by not consuming it all. It also allows for the DSP to be used with different encodings.

Network Specific The network specific allocation should be less than 20 digits if this DSP structure is to be used with any IDI format. This is increased to 27 for the Telex format.

9.1 X.25(80) Allocation

The IDP/Prefix identifies an X.25(80) subnetwork. There is a need to represent a DTE Number, and optionally an X.25 Protocol ID or CUDF (many implementations require these due to shortage of X.121 address space) in the DSP. This is structured in one of two possible ways:

Digit	1	Remainder
Meaning	0	DTE

Digit	1	2	3 – (n*3)+2	Remainder
Meaning	Type	PID/CUDF Length	PID/CUDF	DTE
Values	1 or 2	n		

The network specific part is structured as follows:

Type This has the following values

0 DTE only

1 DTE + PID

2 DTE + CUDF

3-9 Reserved

PID/CUDF Length The length of the PID/CUDF in octets

PID/CUDF The PID/CUDF takes as many digits as indicated by 3 times octet 2. Each octet of the PID/CUDF is encoded as three decimal digits, representing the decimal value of the octet.

DTE The DTE is terminated by the end of the Network Address.

For example, the JANET DTE 000005111600 with ASCII CUDF "12" would be encoded in the following way. The first lines describe the abstract notation. Note that where the IDI is not of maximum length, that the translation to concrete decimal is not mechanical

Part	IDP		DSP			
Component	AFI	IDI	Prefix	Dte+Cudf	Len	CUDF + DTE
Octet			1-2	3	4	5-20
Value	Telex	007 28722	02	2	2	049050 000005111600
Cncrt Decimal	54	007 28722	02	2	2	049050 000005111600
Cncrt Binary	54	00 72 87 22	02	22		04 90 50 00 00 51 11 60 0f

Note that concrete binary is representing octets in hexadecimal. This is the syntax most likely to be used in practice. The CUDF is represented by two octets 049 and 050 (decimal), which map to six digits.

9.2 TCP/IP (RFC 1006) Allocation

The IDP and 2 digit prefix identifies a TCP/IP network where RFC 1006 is applied. It is necessary to use an IP Address, as there are insufficient bits to fit in a domain. It is structured as follows:

Digit	1-12	13-17 (optional)	18-22 (optional)
Meaning	IP Address	port	Transport Set

For TCP/IP there shall be a 20 digit long network-specific part. First 12 digits are for the IP address. The port number can be upto 65535, and needs 5 digits (this is optional, and is defaulted as defined in RFC 1006). Finally, there is a third part to the address, which is defined here as "transport set" that indicates what kind of IP-based transport protocols is used. This is a decimal number from 0-65535 which is really a 16-bit flag word. 1 is TCP, 2 is UDP. If the transport set is not there or no bits are set, it means "default" which is TCP. This is encoded in 5 digits.
Note that RFC 986 is not appropriate [CB87], as this currently applies to a different architecture (we are considering RFC 1006 here).
For example, the IP Address 10.0.0.6 with port 9 over UDP is encoded as:

Part	IDP		DSP			
Component	AFI	IDI	Prefix	IP Address	Port	T Set
Octet			1-2	3-14	15-19	20-24
Value	Telex	007 28722	03	010 000 000 006	00009	00002
Concrete Decimal	54	007 28722	03	010 000 000 006	00009	00002
Concrete Binary	54	00 72 87 22	03	01 00 00 00 00 06	00 00 9	0 00 02

10 Other Forms

Recognition of other forms of address is a local matter.

11 Transport Bridges

The provision of this form of Network Address encoding will facilitate the transparent use of Transport Bridges. Whenever a protocol is used which can carry the Network Address, this can be used to contact a transport bridge as if it was the end system [5]. The hex (concrete) form of network address should be used.

12 Encoding

This document describes allocation of Network Addresses, with the DSP considered in Abstract Decimal. The encoding of this for use in protocols (typically as Concrete Binary) is described in ISO 8348 Addendum 2 [ISO87a].

13 Conclusions

This is all pretty horrible, but there do not appear to be any better choices.

14 References

References

[CB87] R. Callon and H. Braun. Guidelines for the use of internet-ip addresses in the iso connectionless-mode network protocol. Request for Comments 986, DDN Network Information Center, SRI International, November 1987.

[CCI88] The directory - overview of concepts, models and services, December 1988. CCITT X.500 Series Recommendations.

[ISO87a] Information processing systems - data communications - network services definition: Addendum 2 - network layer addressing, March 1987. ISO TC 97/SC 6.

[ISO87b] ISO DIS 7498-3 on naming and addressing, May 1987. ISO/IEC/JTC-1/SC 21.

[Kil88] S.E. Kille. The QUIPU directory service. In *IFIP WG 6.5 Conference on Message Handling Systems and Distributed Applications*, pages 173–186. North Holland Publishing, October 1988.

[5] This suggests that it would be beneficial to extend RFC 1006 to carry Network Addresses.

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[Ros90] M.T. Rose. The ISO development environment: User's manual (version 6.0), January 1990.

[SA88] F. Sirovich and M. Antonellini. The THORN X.500 distributed directory environment. In *Esprit Conference Week*, November 1988.

[TC386] ECMA TC32. Domain specific part of network layer addresses. ECMA Standard 117, ECMA, June 1986.

15 Security Considerations

Security considerations are not discussed in this INTERNET–DRAFT .

16 Author's Address

Steve Kille
Department of Computer Science
University College London
Gower Street
WC1E 6BT
England

Phone: +44-71-380-7294

EMail: S.Kille@CS.UCL.AC.UK

A Allocations for well known networks

A.1 Values

This appendix gives an allocation for three well known networks. All are allocated on the basis of the supposed Telex number 00728722. This might be the University College London Telex number, dependent on whether the UK Telex code is 007, 51, or 051. This number is being used in pilot operations, and so is retained here.

Net	Telex	Prefix
International X.25	007 28722	01
Janet	007 28722	02
Darpa/NSF Internet	007 28722	03

The international X.25 allocation is only used where a CUDF or PID is needed. In other cases, an X.121 form Network Address with no DSP should be used.

A.2 Delegation

The values assigned in this document are now in widespread use. As the number is arbitrary, it would be undesirable to change the numbers without a sound technical reason. However, it is important to guarantee that the numbers are stable.
This Internet Draft comits UCL not to reassign the portions of the number space allocated here.
The DARPA/NSF Internet space (Prefix 03) is delegated to *appropriate Internet body.*