

The Structure and Coding of Logical Link Control (LLC) Addresses: A Tutorial Guide

Introduction

The standards for local area networks (LANs) are generally comprised of the physical layer, the medium access control (MAC) sublayer, and the logical link control logical link control (LLC) sublayer. Two address spaces are used for addressing within the LLC sublayer:

1. The Ethernet type; and
2. The logical link control (LLC) address used by the protocols defined in IEEE Std. 802.2.

The LLC address space is limited, and it is such that it is considered to be a scarce resource. It is therefore prudent to consume this resource in a considered and conservative manner. To this end this TR indicates the kind of considerations, which will be used by ISO/IEC when making the association between a particular LLC address value and use to which it is put. These considerations are intended to be sufficiently broad to allow a wide variety of LLC address uses to be recorded, and also sufficiently restrictive so that addresses values are not unwisely assigned.

Scope

This tutorial provides the following:

- a) A description of the ISO/IEC 8802-2 LLC addressing conventions, and
- b) The consideration for the manner in which new LLC address uses are assigned an entry in this TR.

Functions of LLC addresses

LLC protocol data units (PDUs) contain addressing information. This addressing information consists of two fields; the Destination Service Access Point (DSAP) address field, and the Source Service Access Point (SSAP) address field. Each of these is an 8-bit field and each is made up of two components.

In the DSAP address field, the components are an address type designation bit, and seven bits of actual address. When the address type designation bit is set to '0', it denotes that the actual address is an individual address. When the address type designation bit is set to '1', it denotes that the DSAP actual address is a group address. This tutorial material considers the two types of actual address separately.

In the SSAP address field, the components are the command/response identifier bit, and seven bits of actual address. The actual address in the SSAP field is always an individual address.

Structure and Coding of LLC Addresses

In the general case, an individual actual address identifies a protocol, or set of protocols, in the next higher layer. In OSI environments, the next higher layer is the network layer. In non-OSI environments, the next higher layer is dependent on the architecture in use.

There are certain exceptions to this general rule as discussed below.

Notes

- I. The terms in italics, namely; address type designation bit, command/response identifier bit and actual address are as defined in ISO/IEC 8802-2.
- II. The format of LLC addresses is defined in ISO/IEC 8802-2. For information this is reproduced in Annex A.
- III. An individual actual address value does not necessarily have any relationship with a group address of the same actual address value.

Binary and Hexadecimal Representation of LLC Addresses

Binary representation

The seven-bit LLC actual address value is conveyed in the eight-bit DSAP/SSAP fields and therefore can be represented in a sequence of eight binary digits. The least significant digit is shown to the left and the significance of the digits increases from left to right. The least significant digit of the sequence represents the address type designation bit of the DSAP address field and the command/response identifier bit of the SSAP address field. This is shown in Figure A.1 below.

The following are the two permitted binary representations of an example individual actual address;

0111 1011
Z111 1011

The following is the permitted binary representation of an example group actual address;

1101 0101

Hexadecimal representation

The eight-bit binary representation of an actual address value may be represented as two hexadecimal digits encoding the value of the octet address field with the least significant bit set to 0 in the case of an individual address and the least significant bit set to 1 in the case of a group address.

The following is the permitted hexadecimal representation of the example individual actual address shown in binary representation as (Z111 1011);

DE/DF

The following is the permitted hexadecimal representation of the example group actual address shown in binary representation as (1101 0101);

AB

Bit order of transmission

The order of transmission of bits or other components of the octet address field by any particular MAC is outside the scope of this tutorial material, which describes LLC address values in terms of the significance of individual bits.

The Null Address

Function of the null address

The null LLC address designates the LLC entity associated with the underlying MAC Service Access Point (SAP). The null address does not identify any higher layer protocol nor the LLC sublayer management entity.

The null address is only valid for use in the address fields of XID and TEST PDUs. The use of the null address (DSAP and SSAP) is specified in ISO/IEC 8802-2.

Definition of the null address

The null address (DSAP and SSAP) is defined in ISO/IEC 8802-2.

The Global Address

Function of the Global Address

The global LLC address is an address reserved from the range of group addresses and is used to identify all Link Service Access Points (LSAPs) at the station identified by the MAC address.

Definition of the global address

The global LLC (DSAP) address is defined in ISO/IEC 8802-2.

Note

- I. The global address can only exist as a DSAP address. The individual actual address value '1111 1111' in DSAP and SSAP address fields is a different address and should not be confused with the global address.

The LLC Address Used in Conjunction with ISO/IEC TR 9577

The mechanisms described in ISO/IEC TR 9577 is an important feature and provides a means for standardised network layer protocols to be self identifying. Protocols within the scope of ISO/IEC TR 9577 do not therefore need to be separately identified by means of distinct individual actual address values. A specific individual actual address has been assigned to ISO/IEC TR 9577.

Considerations described below include the notion that whenever possible, new network layer protocols should be identified by ISO/IEC TR 9577.

It might not be possible in all cases to identify the protocol that operates above the LLC sublayer by means of ISO/IEC TR 9577. In these cases, associating that protocol with a different actual address value could be necessary.

Unreserved LLC Addresses

This tutorial describes a range of individual actual addresses as unreserved. The corresponding DSAP and SSAP addresses are in the range 'Z000 0001' through to 'Z011 1111' inclusive (the left most bit is the least significant bit).

This tutorial describes a range of group actual addresses as unreserved. The corresponding DSAP addresses are in the range '1000 0000' through '1011 1111' inclusive (the left most bit is the least significant bit).

Further description of the unreserved addresses is beyond the scope of this tutorial material. They may be used for any purpose whatsoever, including identification of protocols to which reserved addresses have been assigned. The responsibility for controlling the use of unreserved LLC addresses rests with an appropriate authority, for example a system designer, an implementer, or a LAN administrative manager.

Reserved LLC Addresses

This tutorial describes a portion of the individual actual address range as reserved. The corresponding DSAP and SSAP addresses have the general form 'Z1XX XXXX'.

This tutorial describes a portion of the group actual address range as reserved. The corresponding DSAP addresses have the general form '11XX XXXX'.

For each reserved value, the following additional information is provided,

- 1) The standards organisation responsible for the protocol,
- 2) The document reference that records the purpose for which it is being used.

The entries indicate the values that are reserved for use in the documents indicated. All other entries are reserved for future assignment.

Procedures For Assignment Of Reserved Addresses

General considerations

The number of reserved LLC addresses is limited and therefore a case-by-case review against the criteria for assignment. Where possible, the use of complementary mechanisms, for example ISO/IEC TR 9577, is also considered.

Specific procedures

Structure and Coding of LLC Addresses

The need for a higher layer protocol to be assigned is brought to the attention of the IEEE-RA. A request for an LLC address value shall be accompanied by a copy of the protocol standard.

The protocol being proposed for an associated LLC address should be one which

- 1) is a standard published by an internationally recognised standards organisation, and
- 2) is only changed as a result of a public review process, and
- 3) has a potentially large field of application.

Wherever possible, network layer protocols should be identified by using the value for ISO/IEC TR 9577. It is likely therefore that consultation between the IEEE-RA and the submitting member will be needed to ensure that this goal is fulfilled.

If it is not possible to use the mechanisms of ISO/IEC TR 9577 and hence a need for a specific LLC address is evident, then an LSAP address currently unassigned will be made available.

Generally only one use should be associated with each address value. However, in exceptional circumstances, it could be necessary to mark an address value as being used for more than one protocol. Caution should be exercised in associating multiple protocols with a single LLC address value, and considerations could include the fact that the protocols concerned have their own mechanisms for protocol identification, or that they will never coexist in the same installation.

Proposals seeking more than one LLC address value, or a new address value for a revised protocol, which is already associated with an existing LLC address value, will not usually be accepted. It is assumed that modern protocols contain their own version identifiers and hence will be able to interoperate or coexist using a single LLC address value. Therefore, the need for a protocol to be associated with more than one LLC address value would be exceptional.

Requesters are reminded that the available actual addressing space is limited to 7-bits, of which 1 value is defined to be the null actual address, 63 values are unrestricted, and 64 values are controlled by the IEEE RA. Applications for new assignments can therefore expect to be scrutinised to ensure that the consumption of addressing is done in a careful and considered manner.

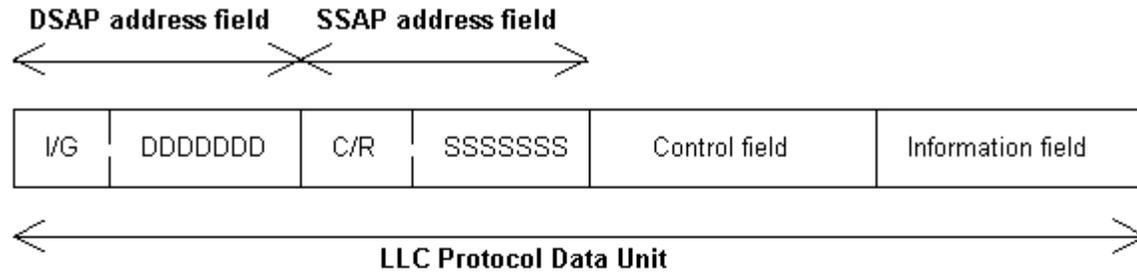
Notes

- i. The term standard is used in a broad sense to include standards at an advanced stage of development (e.g., a Draft International Standard or a ITU-T Recommendation).

Vendor proprietary protocols shall not be assigned a reserved LLC address value. The mechanism provided in IEEE 802 Sub-Network Access Protocol (SNAP) may be applicable in these cases.

Annex A - General format of ISO/IEC 8802-2 addresses

For the benefit of readers of this Technical Report, the LLC address format , as specified in ISO/IEC 8802-2, is illustrated in figure A.1.



I/G = *Address type designation bit (indicating individual or group actual addresses)*

0 = Individual DSAP
1 = Group DSAP

C/R = *The command/response identifier bit*

0 = Command } The value of the C/R bit is set by the
1 = Response } operation of the LLC protocol

D D D D D D D = Destination *actual address*
S S S S S S S = Source *actual address*

Note

- i. A complete LLC PDU is shown so that the address fields can be seen in context.
- ii. The leftmost bit of each field is the least significant bit.
- iii. The Information field is not present in all LLC PDUs

Figure A.1 - Format of the LLC address fields