TM

ODI Specification Supplement: Canonical and Noncanonical Addressing

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CHSM, C language Hardware Specific Module, CMSM, C language Media Support Module, CTSM, C language Topology Specific Module, Internetwork Packet Exchange, ODI, Open Data-Link Interface, LSL, Link Support Layer, MLID, Multiple Link Interface Driver, MLI, Multiple Link Interface, MPI, Multiple Protocol Interface, MSM, Media Support Module, TSM, Topology Support Module, HSM, Hardware Support Module, RX-Net, NE1000, NE2000, NE/2, NE2-32, and NTR2000 are trademarks of Novell, Inc.

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Overview

This supplement describes how to implement canonical and noncanonical addressing. It also discusses when to use canonical addresses and when to use noncanonical addresses.

This supplement contains reference material.

⚠ **Important** This document applies to MLIDs that are written in the Assembly and C languages. Therefore, please note the following convention for configuration table field names:

Table 1 Configuration Table Field Names

Configuration Table Field Names

Document Convention	**Assembly Language**	**C Language**
NodeAddress	NodeAddress	MLIDCFG_NodeAdress
ModeFlags	ModeFlags	MLIDCFG_ModeFlags

In addition, all references to the MSM, TSM and HSM also refer to the CMSM, CTSM and CHSM for those MLIDs that are written in C language. The variable name *MSMPhysNodeAddress* variable name also refers to the variable name *CMSMPhysNodeAddress* for C language MLIDs.

▲

Specifying Canonical and Noncanonical Addresses

The ODI specification requires that all addresses passed through the LSL indicate whether the address is in canonical, noncanonical, or unspecified format. This enables the MLIDs to conform to the IEEE 802.1d MAC Layer Bridging specification, which states that all addresses presented to the Data-Link Layer must be canonical. The RFC 1231 for IEEE 802.5 Token-Ring Management Information Base (for SNMP) also requires canonical addressing.

Canonical Addressing Defined

Addresses that are sent on the wire with the least significant bit of each byte first are in *canonical* (LSB) form. Those sent with the most significant bit of each byte first are in noncanonical (MSB) form.

Ethernet Physical Layer addresses are sent with the least significant bit of the most significant byte first on the wire (canonical). The Physical Layer format of most media is canonical. Token-Ring Physical Layer addresses are sent with the most significant bit (MSB) first on the wire (noncanonical). The Ethernet topology uses the first bit on the wire to specify multicast addresses. The Token-Ring topology uses the first four bits on the wire to specify functional addresses. An example address is shown below in both canonical and noncanonical format:

Canonical:	0800 005A 646B
Noncanonical:	1000 005A 26D6

Note LSB is an acronym for Least Significant Bit. In this case, LSB mode means the address is in canonical format. MSB is an acronym for Most Significant Bit. In this case, MSB mode indicates the address is in noncanonical format. ▲

All specified addresses passed between the layers of the ODI specification are in canonical form unless the MLIDs are configured otherwise. (For example, the address form of the MLIDs written prior to the NetWare v3.12 specification is unspecified.) Noncanonical addresses must be Octet Bit Reversed in order to be canonical.

Note The default mode for Token-Ring is MSB. Even though FDDI uses noncanonical (MSB) addresses at the Physical Layer, it presents canonical (LSB) addresses to the Data-Link Layer. When “LSB” is not specified following the frame type, the node address format used in the configuration table is canonical.

Only Token-Ring MLIDs can select between MSB and LSB. All other MLIDs must use LSB. ▲

Addresses Required to be in Canonical Format

The following addresses must conform to the canonical (LSB) format if the MLID is so configured:

- Node address in the configuration table's *NodeAddress* field
- Address in the *ImmediateAddress* field of the ECB
- Functional and multicast addresses

Determining Address Format

Media that use the MSB format at the Physical Layer require several format cases to be handled by the MLID. The protocol stack examines the MLID's configuration table *ModeFlags* field to determine whether this is the case.

Node Addresses

A 2-bit field has been added to the *ModeFlags* field in the configuration table to support canonical addressing at the Physical Layer in the MLID. Bits 14 and 15 indicate the MLID's support for using different node address formats. (See Table 1.) Bit 15 denotes whether the MLID is Octet Bit Reversal (OBR) aware and uses *MSMPhysNodeAddress*; bit 14 indicates whether the *NodeAddress* field. contains a canonical (LSB) or noncanonical (MSB) node address. Both bits are determined by the HSM and by its parameters.

Table 1
Possible Combinations of *ModeFlags*

Possible Combinations of *ModeFlags*, Bits 14 and 15

Bit 15	Bit 14	Meaning
0	0	Node address format is unspecified. (The node address is in the Physical Layer's native format.) Octet Bit Reversal (OBR) is not supported. The MLID is passing its physical address in the *NodeAddress* field in the configuration table.
0	1	Illegal value. The state of bit 14 is only defined when bit 15 is 1.

Possible Combinations of *ModeFlags*, Bits 14 and 15 (continued)

Bit 15	Bit 14	Meaning
1	0	Node address format is canonical (LSB); OBR is supported. The *MSMPhysNodeAddress* variable contains the MLID's physical address. The *NodeAddress* configuration table field contains the MLID's logical address.
1	1	Node address format is noncanonical (MSB); OBR is supported. The *MSMPhysNodeAddress* variable contains the MLID's physical address. The *NodeAddress* configuration table field contains the MLID's logical address.

Bit 14 indicates whether the MLID is using the LSB or MSB mode. Bit 15 indicates that the MLID is LSB/MSB-aware. If bit 15 is set, the HSM uses the *MSMPhysNodeAddress* variable when it initializes or resets the hardware, and uses bit 14 to determine whether the address is in LSB or MSB format. If bit 14 is clear (the address is in LSB format), but the hardware supports node addresses in MSB, the MLID saves a copy of the physical address in case the MLID reset routine must program the adapter's individual address.

Note Addressing is easier if you remember that the MLID's node address, and any other address that it passes to the LSL and the protocol stacks, always reflects the settings of bits 14 and 15 in the *ModeFlags* field. For example, if the MLID uses noncanonical mode, all addresses given it will be noncanonical. If the MLID uses canonical mode, all addresses given to it are canonical. The MLID must handle all bit-swapping issues in order to ensure that its address conforms to the required Physical Layer format. ▲

The *NodeAddress* override is configurable as either canonical or noncanonical. (See the section "Overriding the Configuration Table *NodeAddress* Field" on page 9).

Important We strongly recommend that the MLID sets bit 15 in the *ModeFlags* field equal to 1. Only MLIDs written prior to NetWare v3.12 should have bit 15 set to 0. ▲

MSMPhysNodeAddress and NodeAddress

The MSM defines a 6-byte variable named *MSMPhysNodeAddress* to provide the MLID's node address in the Physical Layer format. The configuration table

NodeAddress field contains the configured node address. This means that the address in the *NodeAddress* field is in a canonical, noncanonical, or unspecified format as indicated by *ModeFlags* bits 14 and 15 (see Table 1). For example, if OBR support is enabled, the Token-Ring address 1000 005A 26D3h appears in the configuration table as follows:

NodeAddress (configuration table)	0800 005A 64CBh
MSMPhysNodeAddress (MSM variable)	1000 005A 26D3h

The *MSMPhysNodeAddress* variable is held in an instance table of MSM variables. The HSM references the variable with a pointer to the start of this table. The MSM passes this pointer to the HSM when the MSM calls the *DriverInit* routine.

Noncanonical Format Media

MLIDs for media that use noncanonical (MSB) node address indicate that they support canonical (LSB) node addresses by placing “LSB” following the frame type. Client and server MLIDs indicate this in the following manner.

Client MLIDs	place “LSB” following the frame type keyword in the NET.CFG file.
Server MLIDs	place “LSB” following the frame type keyword either in the AUTOEXEC.NCF file or on the command line.

If the MLID is in noncanonical mode, it sets both bits 14 and 15 in the *ModeFlags* field.

Canonical Format Media

For media with canonical Physical Layer format, the MLID always sets bit 15 and clears bit 14. This indicates that the *NodeAddress* field in the configuration table is in canonical format and that the HSM is using the *MSMPhysNodeAddress* variable when it initializes or resets the hardware.

Format of Addresses Passed through the MLID

All addresses passed between the HSM and the MSM are in Physical Layer format. If the Physical Layer transmits addresses in noncanonical format, these addresses (for example, the addresses in the are passed in noncanonical format.

ImmediateAddress Event Control Block Field

If *ModeFlags* bits 14 and 15 are set, the ECB’s *ImmediateAddress* field will be canonical on sends, and the MLID should set it in canonical format on receives.

If the MLID is configured for canonical format, all destination addresses (in TCBs) and source addresses (in RCBs) should be in canonical format. If the MLID is not configured for canonical mode, these addresses should be in the physical layer format of the MLID. If the MLID is configured for canonical (LSB) format, these addresses must be passed in canonical format.

Functional Addresses

The MSM manipulates functional addresses as needed to provide the correct address values to the physical medium. In other words, if the MLID is configured for canonical (LSB) format, all functional addresses (for example, in Token-Ring) must be passed to the MLID in canonical format. The MSM then translates these addresses to noncanonical format when it passes them to the HSM. If the HSM is not configured for canonical format, or does not support OBR, all functional addresses passed to the MLID are in the Physical Layer format.

Source Routing Addresses

Source routing addresses are presented in the format that the HSM uses (for example, Token Ring source routing addresses are noncanonical and FDDI source routing addresses are canonical). If the MLID is written in Assembly language, the ROUTE.SYS file controls all source routing issues.

Raw Sends

The protocol stack delivers Raw Send packets in the correct format for the HSM. MLIDs that support Raw Sends should assume all Raw Send packets are in the correct format for the HSM. FDDI is an exception. Because most FDDI hardware can be configured to bit swap the addresses, the protocol stacks must fill in raw sends with canonical addresses.

Other Address Format Issues

MAC headers reflect the format of the HSM.

Physical Layer MAC Headers

Physical Layer MAC headers on received packets reflect the address format of the media. For example, Token-Ring's MAC header is noncanonical (MSB). The FDDI MAC header is canonical.

Configuring Octet Bit Reversal (OBR)

Keywords

Note The following section describes the Novell-standardized method of handling Octet Bit Reversal. ▲

The user can configure Octet Bit Reversal support to support protocol stacks and frame types that require either canonical or noncanonical addresses. The following keywords enable and disable support for OBR:

LSB	Enable OBR support
MSB	Disable OBR support

If the MLID is written for a client, the user can configure Octet Bit Reversal in the NET.CFG file by adding LSB or MSB to the *Frame Name* keyword.

If the MLID is written for a server, the user can configure Octet Bit Reversal in the AUTOEXEC.NCF file by adding LSB or MSB to the *Frame Name* keyword. Octet Bit Reversal can also be configured at the command line by adding LSB or MSB after the *Frame Name* keyword.

The user adds these keywords to the *Frame Name* configuration line. This allows the MLIDs to be configured on the basis of frame type. For example:

AUTOEXEC.NCF File

```
load TOKEN MSB Frame = Token_Ring
load TOKEN LSB Frame = Token_Ring_SNAP
```

NET.CFG File

```
Link Driver TOKEN
    Node Address 020012345678L
    Frame Token-Ring MSB
    Frame Token-Ring_Snap LSB
```

In the above example, Token-Ring is in noncanonical (MSB) format and Token-Ring_SNAP is in canonical (LSB) format. The appropriate configuration tables for each frame will indicate the MSB/LSB format.

OBR Support Default

The default for Octet Bit Reversal support is media-dependent (noncanonical or MSB) in all Token-Ring drivers. FDDI drivers are canonical (LSB). Even though the FDDI topology's physical addresses are in noncanonical (MSB) form, the ANSI definition of FDDI requires that it passes addresses to the Data-Link Layer in canonical form so that the adapter addresses can be passed across the MAC layer bridges. (For example, an Ethernet or Token-Ring LAN might attempt to pass or receive a packet from an FDDI LAN. In that case, the format of the addresses must be compatible.)

Overriding the Configuration Table *NodeAddress* Field

When you override the *NodeAddress* configuration table field by using the LSB/MSB keywords as described above, you can use whichever format (canonical [LSB] or noncanonical [MSB]) you find most convenient for your topology. For example:

```
Node Address   0800005A646BL      Node address in canonical form.
Node Address   1000005A26D6M     Node address in noncanonical form.
load TOKEN Node =  0800005A646BL
load TOKEN Node = 1000005A26D6M
```

If M or L is not specified, the Token-Ring default for overriding the node address is noncanonical; the Ethernet and FDDI default is canonical.

Note Regardless of the form of the node address override, the node address contained in the configuration table's *NodeAddress* field is reflected by the state of the *MLIDModeFlag*'s bits 14 and 15. (See Table 1.) ▲

A node address override labeled with an "M" (indicating a noncanonical address) is legal even when the media is canonical; the MLID simply bit-swaps the provided address to obtain the appropriate canonical address.

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