Network Working Group
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IP Multicast over Token-Ring Local Area Networks

Status of this Memo

This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Abstract

This document specifies a method for the transmission of IP multicast datagrams over Token-Ring Local Area Networks. Although an interim solution has emerged and is currently being used, it is the intention of this document to specify a more efficient means of transmission using an assigned Token-Ring functional address.

Introduction

IP multicasting provides a means of transmitting IP datagrams to a group of hosts. A group IP address is used as the destination address in the IP datagram as documented in STD 5, RFC 1112 [1]. These group addresses, also referred to as Class D addresses, fall in the range from 224.0.0.0 to 239.255.255.255. A standard method of mapping IP multicast addresses to media types such as ethernet and fddi exist in [1] and RFC 1188 [2]. This document attempts to define the mapping for an IP multicast address to the corresponding Token-Ring MAC address.

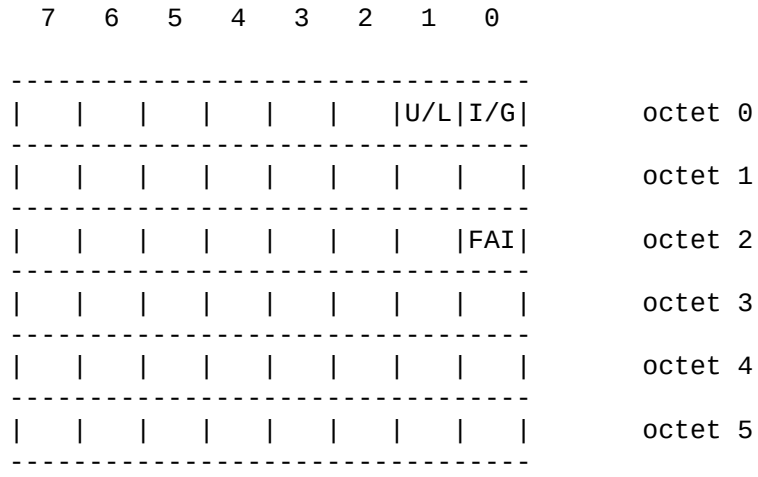
Background

The Token-Ring Network Architecture Reference [3] provides several types of addressing mechanisms. These include both individual (unicast) and group addresses (multicast). A special subtype of group addresses are called functional addresses and are indicated by a bit in the destination MAC address. They were designed for widely used functions such as ring monitoring, NETBIOS, Bridge, and Lan Manager frames. There are a limited number of functional addresses, 31 in all, and therefore several unrelated functions must share the same functional address.

It would be most desirable if Token-Ring could use the same mapping as ethernet and fddi for IP multicast to hardware multicast addressing. However, current implementations of Token-Ring controller chips cannot support this. To see why, we must first examine the Destination MAC address format.

Destination Address Format

The destination MAC address consists of six octets. In the following diagram of a MAC address, the order of transmission of the octets is from top to bottom (octet 0 to octet 5), and the order of transmission of the bits within each octet is from right to left (bit 0 to bit 7). This is the so-called "canonical" bit order for IEEE 802.2 addresses. Addresses supplied to or received from token ring interfaces are usually laid out in memory with the bits of each octet in the opposite order from that illustrated, i.e., with bit 0 in the high-order (leftmost) position within the octet.



The low order bit of the high order octet is called the I/G bit. It signifies whether the address is an individual address (0) or a group address (1). This is comparable to the multicast bit in the DIX Ethernet addressing format.

Bit position 1 of the high order octet, called the U/L bit, specifies whether the address is universally administered (0) or locally administered (1). Universally administered addresses are those specified by a standards organization such as the IEEE.

If the I/G bit is set to 1 and the U/L bit is 0, the address must be a universally administered group address. If the I/G bit is 1 and the U/L bit is a 1, the address may be either a local administered group address or a functional address. This distinction is determined by

the Functional Address Indicator (FAI) bit located in bit position 0 of octet 2. If the FAI bit is 0, the address is considered a functional address. And if the FAI bit is 1, this indicates a locally administered group address.

Different functional addresses are made by setting one of the remaining 31 bits in the address field. These bits include the 7 remaining bits in octet 2 as well as the 8 bits in octets 3, 4, and 5. It is not possible to create more functional addresses by setting more than one of these bits at a time.

Three methods exist for mapping between an IP multicast address and a hardware address. These include:

1. The all rings broadcast address

2. The assigned functional address

3. The existing IEEE assigned IP Multicast group addresses

In order to insure interoperability, all systems supporting IP multicasting on each physical ring must agree on the hardware address to be used. Therefore, the method used should be configurable on a given interface. Bridges may provide a means to translate between different methods for each physical ring that is being bridged. Method (3) is recommended but due to hardware limitations of Token-Ring controller chips, may not be possible. In this case, Method (2) is preferred over Method (1). For backward compatibility, systems that support (2) MUST also support (1). And systems that support (3) MUST also support (2) and therefore (1). In the absence of configuration information, the default should be to use the assigned functional address (2).

IP Multicast Functional Address

Because there is a shortage of Token-Ring functional addresses, all IP multicast addresses have been mapped to a single Token-Ring functional address. In canonical form, this address is 03-00-00-20-00-00. In non-canonical form, it is C0-00-00-04-00-00. It should be noted that since there are only 31 possible functional addresses, there may be other protocols that are assigned this functional address as well. Therefore, just because a frame is sent to the functional address 03-00-00-20-00-00 does not mean that it is an IP multicast frame.

Acknowledgments

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References

[1] Deering, S., "Host Extensions for IP Multicasting", STD 5, RFC 1112, Stanford University, August 1989.

[2] Katz, D., "A Proposed Standard for the Transmission of IP Datagrams over FDDI Networks", RFC 1188, Merit/NSFNET, October 1990.

[3] IBM Token-Ring Network, Architecture Reference, Publication SC30-3374-02, Third Edition, (September, 1989).

Security Considerations

Security issues are not discussed in this memo.

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