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## A MAPOS version 1 Extension - Node Switch Protocol

### Status of this Memo

This memo provides information for the Internet community. This memo does not specify an Internet standard of any kind. Distribution of this memo is unlimited.

### Abstract

This document describes a MAPOS extension, Node Switch Protocol, for automatic node address assignment. MAPOS is a multiple access protocol for transmission of network-protocol datagrams, encapsulated in High-Level Data Link Control (HDLC) frames, over SONET/SDH. NSP automates the HDLC address configuration of each node. Using NSP, a node retrieves its HDLC address from the switch to which it is connected.

### 1. Introduction

MAPOS[1], Multiple Access Protocol over SONET(Synchronous Optical Network)/SDH(Synchronous Digital Hierarchy)[2][3][4][5], is a protocol for transmission of HDLC frames over SONET/SDH. A SONET switch provides multiple access capability to each node. In MAPOS, each node has a unique HDLC address within a switch. The address is equivalent to the port number of the switch to which the node is connected. This document describes an extension to MAPOS, Node Switch Protocol, which enable automatic HDLC address assignment. First, it explains the addressing of MAPOS. Then, it describes the NSP protocol for automatic HDLC node address assignment.

### 2. Node Address Format

This section describes MAPOS Version 1 address format in single and multiple switch environment.

## 2.1 Address Format

In MAPOS network, each end node has a unique HDLC address. As shown in Figure 1, the address length is 8 bits. The LSB is always 1 which indicates the end of the field. When a SONET switch receives an HDLC frame, it forwards the frame based on the address in the frame header.

In unicast, MSB is 0 and the rest of the bits are the port number to which a node is connected. Since the LSB is always 1, the minimum and maximum addresses are 0x01 and 0x7F, respectively. Address 0x01 is reserved and is assigned to the control processor in a SONET switch.

In broadcast, MSB is 1 and the rest of the bits are all 1s. In multicast, MSB is 1 and the rest of the bits, except for the LSB, indicate the group address.

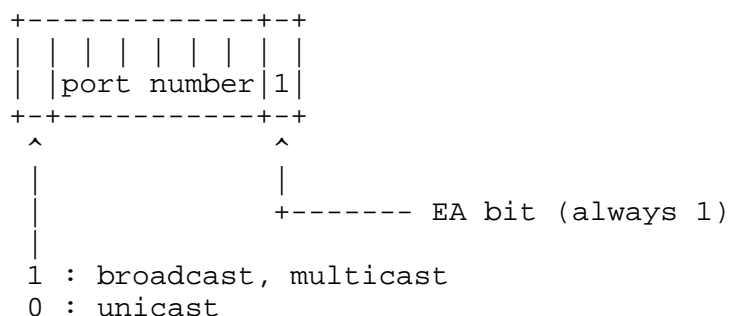


Figure 1 Address format

## 2.2 Address in multi-switch environment

In a multi-switch environment, variable-length subnet addressing is used. Each switch has a switch number that is unique within the system. Subnetted node addresses consist of the switch number and the port number to which a node is connected. The address format is "0 <switch number> <node number> 1" for a unicast address, "all 1" for the broadcast address, and "1 <group address> 1" for a multicast address.

The address 0x01 is reserved and is assigned to the control processor in the "local" switch. That is, it indicates the switch itself to which the node is connected. The addresses of the form "0 <switch number> <all 0> 1" are reserved, and indicates the control processor of the switch designated by the switch number.

In Figure 2, the switch numbers are two bits long. Node N1 is connected to port 0x3 of switch S1 numbered 0x1 (01 in binary). Thus,

the node address is  $0 + 01 + 00011$ , that is,  $00100011(0x23)$ . Node N3 has an address  $01001001(0x49)$ , since the switch number of S2 is  $0x2$  (10 in binary) and the port number is  $0x09$ . Note that all the port numbers are odd because the LSBs are always 1.

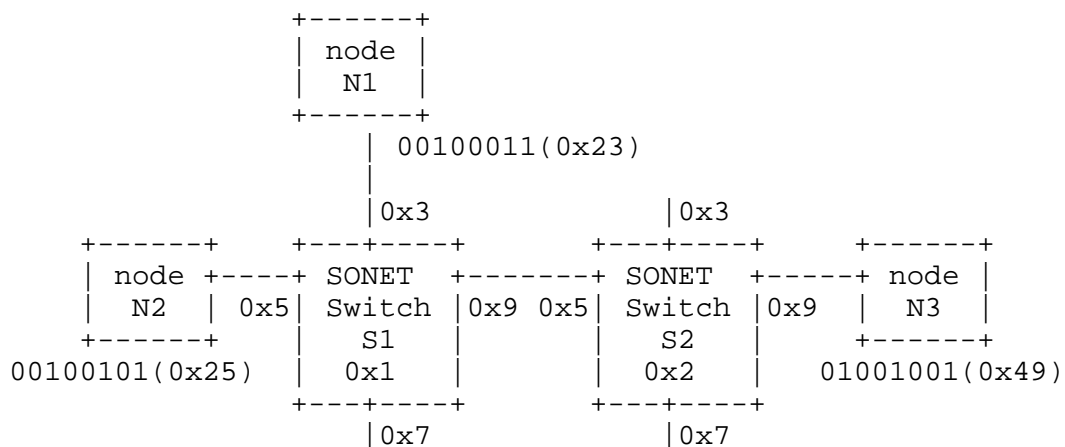


Figure 2 Addressing in Multiple Switch Environment

#### 4 NSP(Node-Switch Protocol)

This section describes the NSP protocol used for automatic node address assignment.

##### 4.1 NSP protocol

NSP is introduced to provide an automatic node address assignment function in MAPOS version 1. It reduces the administrative overhead of node address configuration for each node and prevents troubles such as address inconsistency and collision. When a node is connected to a switch and receives S1 signal correctly, the node sends an address request packet to the control processor in the local switch. The destination address of this packet is  $00000001(0x01)$ . When the control processor receives the packet, it replies with an address assignment packet. The destination is the assigned node address. If the node does not receive the address assignment packet within 5 seconds, it retransmits the address request packet. The retransmission continues until the node successfully receives the address assignment packet.

Whenever a node detects a transmission error such as carrier loss or out-of-synchronization, it SHOULD send an address request packet to the control processor and verify its current address. In addition, a node MUST verify its address by sending address request packets every

30 seconds. The switch regards them as keep-alive packets and utilizes them to detect the node's status. If it has not received a request packet for more than 90 seconds, it assumes that the node went down. In addition, it also assumes the node went down when a switch detects a SONET signal failure.

## 4.2 Packet Format

The HDLC protocol field of a NSP frame contains 0xFE03 (hexadecimal) as defined by the "MAPOS Version 1 Assigned Numbers" [6]. The information field contains the NSP packet as shown in Figure 3.

```

+-----+-----+
I  command  I  address  I
+-----+-----+
I<- 32bit ->I<- 32 bit ->I

```

Figure 3 NSP packet format

The command field is 32 bits long and has the following values (in decimal);

1	address request
2	address assignment
3	reject(error)

The length of the address field is 32bits. In address request packets, the NSP address field SHOULD be filled with zeroes, although the switch ignores it. In address assignment packets, the assigned address is placed in the least significant byte of the field. The rest of the field is padded with zeroes. When the switch can not assign the address for some reason, the switch replies with a reject command (the values is 3). The value of the address field is undefined.

## 4.3 Consideration for special cases

There are two special cases to consider. One is a point-to-point connection without a switch. The other is loop-back, that is, direct connection between the input and the output of the same port.

### 4.3.1 point-to-point

In the case of a point-to-point connection shown in Figure 4, a node sends an address request packet to the other node. The destination address is 00000001(0x01), that is usually a control processor in a switch. When a node receives the address request, it detects the

point-to-point connection by examining both the destination address and the command contained. Then, it MUST reply with an address assignment packet. The assigned address MUST be 00000011(0x03). Since both nodes send an address request to each other, both of them get address 00000011(0x03). Since any address can be used in point-to-point environment, there is no problem even if both of the nodes have the same address.

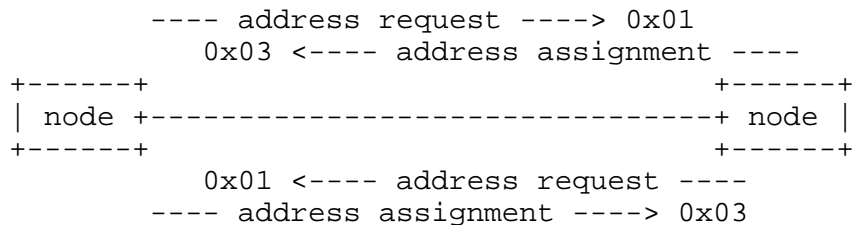


Figure 4 Point-to-point connection

#### 4.3.2 loop-back

Another special case is loop-back where the output port of a node is simply connected to its input port as shown in Figure 5. In this case, the same mechanism as that for point-to-point can be applied without modification. A node sends an address request packet destined to 00000001(0x01). The node then receives the same packet. Since the destination is 00000001(0x01), it replies with an address assignment packet, containing the assigned address 00000011(0x03), to the address 0000 0011(0x03). Thus, the node obtains the address 00000011(0x03).

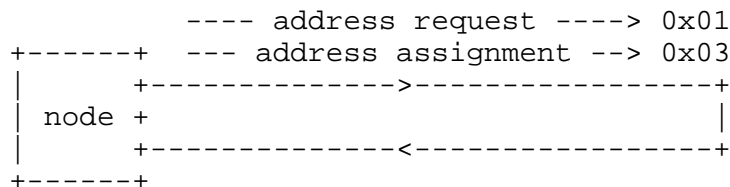


Figure 5 Loop-back Configuration

## 5. Security Considerations

Security issues are not discussed in this memo.

## References

- [1] Murakami, K. and M. Maruyama, "MAPOS - Multiple Access Protocol over SONET/SDH, Version 1," RFC-2171, June 1997.
- [2] CCITT Recommendation G.707: Synchronous Digital Hierarchy Bit Rates (1990).
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- [5] American National Standard for Telecommunications - Digital Hierarchy - Optical Interface Rates and Formats Specification, ANSI T1.105-1991.
- [6] Maruyama, M. and K. Murakami, "MAPOS Version 1 Assigned Numbers," RFC-2172, June, 1997.

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