System 7.5.3 and Physical Ethernet Address Change (6/96)

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TOPIC -----

After installing System 7.5 Update 2.0 (System 7.5.3) I noticed the Ethernet hardware address of the computer changed from 00:A0:40:xx:xx:xx to 00:05:02:xx:xx:xx. Why did this occur? Is this due to Open Transport 1.1?

DISCUSSION -----

Apple was initially assigned Ethernet physical (Media Access Control) addresses of 08:00:07:xx:xx:xx. Apple NuBus and on-board Ethernet implementations from 1989 through part of 1995 were given addresses from this range. In 1995, however, Apple began to reach the end of the available addresses in that range, and petitioned the IEEE for an additional vendor code (address range) assignment. We were granted 00:A0:40. Apple began using these new addresses (00:A0:40:xx:xx:xx) in some of our Ethernet implementations in mid-year 1995.

MAC addresses are typically stored in an EPROM (erasable programmable read-only memory) on the Ethernet chip set, in what is known as "Token Ring format". This format has each byte stored in nibble-reversed order. For example:

Begin_Table

Ethernet format (hex):	00	A0	40
Binary equivalent:	0000 0000	1010 0000	0100 0000
Token Ring format (hex):	00	05	02
Binary equivalent:	0000 0000	0000 1010	0000 0010

End_Table

Some Macintosh computers, Power Macintosh 7200, 7500, 8500, and 9500, and some Apple NuBus Ethernet cards, had their MAC address mistakenly stored in Ethernet format; not in the standard Token Ring format. That is, rather than storing the address as 00:05:02:xx:xx:xx and then converting to yield the assigned address range of 00:A0:40:xx:xx:xx, the addresses were stored as 00:A0:40:xx:xx:xx and would have been converted to 00:05:02:xx:xx:xx.

At the same time, however, there was a bug in the Open Firmware code for Power Macintosh 7200, 7500, 8500, and 9500 computers that caused those systems to NOT

convert the address stored in the EPROM. The end result was the correct MAC addresses (00:A0:40:xx:xx:xx) were being used by these Ethernet implementations on the wire, even though they were stored in the incorrect format. (A rare case of "two wrongs do make a right".)

Many Apple and third-party network management utilities also access the EPROM to read the MAC address, and correctly assume it will be stored in Token Ring format. Therefore they convert the stored address before presentation to the user. As a result, such as utility would report an address of 00:05:02:xx:xx:xx, even though a network analyzer packet trace would show an address in the range 00:A0:40.

Apple NuBus Ethernet cards, with MAC addresses in the new range, were more problematic. Because the Open Firmware bug did not affect these cards (Open Firmware is a PCI specific technology), the MAC addresses were converted from 00:A0:40:xx:xx:xx to 00:05:02:xx:xx:xx, resulting in the use of unauthorized addresses on the wire. Fortunately, the 00:05:02 range was still unassigned, and these cards did not create inter-operability problems in the field.

Apple has since petitioned the IEEE and been granted the 00:05:02 range, in addition to the already approved 08:00:07 and 00:A0:40 ranges.

System 7.5 Update 2.0 (System 7.5.3) includes a fix for the Open Firmware bug that impacted the Power Macintosh 7200, 7500, 8500, and 9500 computers. A system with an address stored as 00:A0:40:xx:xx:xx (originally considered improper), once updated to Mac OS System 7.5.3, will now appear as 00:05:02:xx.xx.xx on the wire. This change impacted an Open Firmware component; it is not a part of Open Transport v1.1.

As Apple now has official use of the 00:05:02 range, these PCI Mac OS systems now have properly stored addresses. This brings the behavior of all on-board and NuBus Ethernet implementations back together, and lets Apple and third party utilities correctly report these addresses.

These changes were necessary to assure ongoing standards compliance, and to remedy the unintentional compatibility issues with network management utilities.

This situation may impact networks including the Apple Ethernet implementations noted. Specifically, any network access and configuration services which depend upon statically configured MAC addresses will require reconfiguration by the network administrator. Such services can include BootP, DHCP, RARP, certain firewall and security scenarios, some routing Access Control Lists, and smart Ethernet hubs incorporating MAC-level security.

The 00:A0:40 address range is now reserved for future Apple expansion, when the 08:00:07 and 00:05:02 ranges are exhausted.

This situation does not affect Power Macintosh 7200, 7500, 8500, and 9500 computers or other Apple Ethernet implementations with physical Ethernet addresses in the original 08:00:07 range.

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