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Open Transport 1.1.1 and MacOS System 7.5.3 FAQ (10/96)

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TOPIC -----

This article is the Open Transport 1.1.1 and MacOS System 7.5.3 FAQ (frequently asked questions).

DISCUSSION -----

Question: After installing System Update 2.0 (System 7.5.3) I've noticed that the Ethernet address of a system has changed from 00:A0:40:xx:xx:xx to 00:05:02:xx:xx:xx. Why? Is this due to Open Transport?

Answer: Apple was initially assigned Ethernet MAC (Media Access Control) addresses of 00:08:07: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 mid-year 1995.

MAC addresses are typically stored in an EPROM (erasable programmable read-only memory) on the Ethernet chip set, in "token ring format". This format has each byte stored in bit-reversed order. For example:

Ethernet format (hex):00A040
Binary equivalent: 0000 00001010 00000100 0000
Token ring format (hex):000502
Binary equivalent:0000 00000000 01010000 0010

Some Macintosh systems - the Power Macintosh 7200, 7500, 8500, and 9500 - and some Apple NuBus Ethernet cards had their MAC address unintentionally 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 convert to 00:05:02:xx:xx:xx on the wire.

At the same time, however, there was also a bug in the Open Firmware code for these same systems that caused them to NOT convert the address stored in the EPROM. The result was that the intended MAC addresses (00:A0:40:xx:xx:xx) were being used on the wire by these Ethernet implementations, even though they were not stored in the correct format. (A rare case of "two wrongs do make a right".)

MacOS network utilities also access the EPROM to read MAC addresses, however, and correctly assume the token ring format. Thus they convert stored addresses at the application layer before presentation to the user. When running on one of the affected systems, such a 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.

Because the Open Firmware bug did not apply to Apple NuBus Ethernet cards with MAC addresses in the new range (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 interoperability problems.

Upon original discovery of this situation, Apple quickly petitioned the IEEE and was granted the 00:05:02 range. This was in addition to the already approved 00:08:07 and 00:A0:40 ranges.

System 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 systems. Once updated to MacOS System 7.5.3, these systems will now convert their address before use, and as a result appear as 00:05:02:xx:xx:xx on the wire. This change impacted a Open Firmware component, and was not a part of Open Transport v1.1.

Note that because Apple has been granted use of the 00:05:02 range, these PCI MacOS systems now have properly stored and communicated addresses. This change brings consistency to the behavior of all Apple on-board and NuBus Ethernet implementations, and allows Apple and third party network management utilities to correctly read and report these addresses to users without requiring new versions of utility software.

These changes were necessary to assure ongoing standards compliance, and to remedy the compatibility issues with network management utilities. However, they may impact networks including the Apple Ethernet implementations noted above. Specifically, any network access and configuration services which depend upon statically configured MAC addresses will require reconfiguration by the network administrator once System 7.5.3 is introduced into the environment. Such services can include BootP, DHCP, RARP, certain firewall and security products, 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, at such time as the 00:08:07 and 00:05:02 ranges are exhausted. This situation did not

effect Power Macintosh 7200, 7500, 8500, and 9500 systems or other Apple Ethernet implementations with physical Ethernet addresses in the original 00:08:07 range.

Question: Does System 7.5.3 require the use of Open Transport?

Answer: System 7.5.3 supports and includes both classic and Open Transport networking.

Doing an Easy Install of System 7.5.3 on an 68030, 68040, or NuBus PowerPC MacOS system installs Open Transport v1.1 and classic networking. Easy Install on a 68000 or 68020 Macintosh will install only classic networking. Easy Install on PCI MacOS systems will install only Open Transport.

Question: Why does System 7.5.3 include both classic and Open Transport networking?

Answer: System 7.5.3 includes both classic and Open Transport networking to support a Universal System Folder, which could provide networking services for any MacOS system, from the Mac Classic to the most powerful PowerPC.

Question: Since both Open Transport and classic networking are included with System 7.5.3, which network software will actually be used?

Answer: The networking software used by System 7.5.3 depends upon four factors:

- the configuration of the system where 7.5.3 was installed;
- an initial stored preference, established at system software installation time;
- the configuration of the system currently being booted, which might be the same as or different from the system where 7.5.3 was installed; and
- the user's change to the stored preference, if any.

Together these factors determine the networking software system loaded at system startup (boot) time:

- Classic networking will load and run when booting System 7.5.3 on a 68000 or 68020 Macintosh, even if Open Transport is also installed;
- Open Transport will load and run when booting System 7.5.3 on PCI MacOS systems meeting Open Transport minimum memory requirements, even if classic networking is also installed;
- Both classic and Open Transport options are available on 68030, 68040 and NuBus PowerPC MacOS systems meeting Open Transport minimum memory requirements. The networking software used at boot time is selected based upon the stored preference.

When System 7.5.3 is Easy Installed on these machines, the initial preference is to load and run classic networking. Open Transport can be enabled using the Network Software Selector utility, discussed below.

If Open Transport is Custom Installed from the System Update 2.0, or installed using the stand-alone Open Transport installer, the initial preference is to load and run Open Transport networking. Classic networking can be enabled using the Network Software Selector utility.

- Classic networking will load and run when booting MacOS systems with less than 5 MB (680x0) or 8 MB (PowerPC) total system memory.

If this constrained-memory situation occurs on a 68030, 68040, or NuBus MacOS system, classic networking will load and run, with full support for AppleTalk and MacTCP.

If this constrained-memory situation occurs on a PCI MacOS system - perhaps due to the definition of a large RAM disk - classic networking will become available, but will be limited to support only for AppleTalk on LocalTalk; no TCP/IP services will be available.

Question: What happens if a boot device is moved to a different system after the preference has been established?

Answer: The stored preference for network software will be honored, if possible, at boot time. Whenever the system configuration being booted meets the minimum requirements for the preferred network software, it will load and run. If the stored preference has been deleted, or is not appropriate for the system being booted, the rules noted above around minimum and recommended memory size, processor, and bus type determine which network software system loads.

Question: Why is the network software preference initially set during system installation time? Wouldn't checking system configuration at boot time be a more flexible way to support the Universal System Folder?

Answer: As described above, a number of system configuration checks are made at boot time - including processor, bus type, and system RAM - and influence the choice of network software when booting a Universal System Folder.

On MacOS systems that support both networking software systems, however, an initial preference is established based on system configuration at installation time. For the majority of users, this system (the installation system) is the same one as where the System Folder being created will be used. In these cases, the update / installation script establishes a preference based on the recommended memory configuration (vs. the minimum required memory, which is still always tested at boot time).

There are two reasons for doing this in this manner:

- Testing for minimum memory requirements at system start-up time assures

a compatible hardware-software combination each time a system is booted. If a system configuration changes to fall below Open Transport's minimum memory requirements - which might happen due to reconfiguration, or by moving an external boot device to a different system - System 7.5.3 automatically drops back to classic networking to provide basic connectivity to the outside world.

- When there is no stored preference, System 7.5.3 selects between classic and Open Transport networking based on the system configurations described above. As this check is based on total memory (including VM but less RAM disk), in the absence of a preference, a seemingly unrelated user action such as turning VM on or off could change the network system used at (next) boot time. For example, enabling VM on an 8 MB system would provide at least 9 MB RAM at next startup, moving the system from classic to Open Transport "unexpectedly"; turning on a RAM Disk could cause another reversal. Thus, setting an initial preference "locks in" a predictable behavior.

Question: How can a user specify a preference for a specific network software system, overriding the system installation preference?

Answer: Apple has developed a utility called the "Network Software Selector" (NSS), which allows a user to indicate a preference for classic or Open Transport networking. Network Software Selector is distributed as a part of System 7.5 Update 2.0, and in other System 7.5.3 configurations - it is located in the Apple Extras Folder.

NSS may not be supplied in all configurations of System 7.5.3; for example, PCI MacOS systems manufactured with System 7.5.3 pre-installed may not have the Network Software Selector utility included, because these systems require Open Transport.

To indicate a preference, the user launches NSS and clicks the radio-button control indicating either classic or Open Transport networking. After quitting NSS, the system must be re-started for the preference to have a change to take effect.

Question: Does the Network Software Selector allow a user to specify a preference for a networking system that is "not valid" for the current system configuration?

Answer: Yes, with the Network Software Selector it is possible to set a preference for classic networking while currently booted on a PCI MacOS system, or to set a preference for Open Transport while booted on a 68000 or 68020 Macintosh. This is designed to allow an administrator to prepare an external boot device with an Universal System Folder that has a configuration different than their own machine.

The Network Software Selector indicates a user preference; the actual network software loaded is determined when the system is booted. If a preference for Open Transport is set but the device is a 68000 or 68020, classic networking

would load, ignoring the preference. If that boot volume is moved to a Power Macintosh 9500, Open Transport would load, as this PCI system requires Open Transport. Move the boot volume to a Quadra 800 and restart; Open Transport would load based on the stored preference.

Question: Can the stored preference be deleted? Why might this be a useful action?

Answer: The preference for network software system is stored as a part of the AppleTalk Prefs file, kept in the System Folder. Deleting this file will also delete the stored preference.

In some support environments it may be useful to create a Universal System Folder that does not include a stored preference. For example, if a network administrator's system is configured differently from the systems found with end-users, the preference set at system software installation time (based on the configuration of the administrator's system) may not be optimum for end-users' systems.

If all of the end user population is configured similarly, the network administrator could use the Network Software Selector utility to modify the stored preference before distributing system software. However, if end-users' system configurations vary widely, deleting the preference would have the effect of deferring the selection of network software to boot time for each individual user.

Should an end-user want to "lock-in" a preference for their system, they would need to simply launch and then close the NSS utility on their machine. This records the network system currently in use as the preference.

Question: When might a user want to use NSS to enable Open Transport, disabling classic networking?

Answer: The Network Software Selector provides System 7.5.3 users an easy way to update to Open Transport networking, without requiring custom system software installations.

Open Transport should be enabled when the user is ready to take advantage of any of Open Transport's features, such as multiple saved network configurations, reconfiguration without restart, support for PowerPC native code; when the user want to run Open Transport-ready or Open Transport-enhanced applications; or when a network manager requires the use of Open Transport to connect to a centrally administered network.

Of course, users that have previously dropped back to classic networking in order to maintain compatibility with an older network application will want to re-enable Open Transport once the application has been updated.

Question: When might a user override the default for Open Transport and specify a preference for classic networking?

Answer: The Network Software Selector provides an easy way to temporarily drop back to classic networking, if needed, on systems that support both networking models. There are two reasons why there might be a call to do so:

- a need to maximize RAM available for running applications, especially if VM is turned off; or,
- a need to run older networking software that is not yet Open Transport compatible.

Before dropping back to classic networking, users are encouraged to check with the application developer to find out if an Open Transport-compatible or Open Transport-ready version of the application is available.

Question: On systems that support both classic and Open Transport networking, how are configuration preferences managed? How does the Network Software Selector interact with these preferences?

Answer: When initially installed, Open Transport AppleTalk and TCP Preferences files are created based on the current settings for classic networking. The Prefs files will each contain a single configuration, entitled "Default". Classic settings are not modified by this installation process.

When booted with Open Transport active, classic networking components and preferences are hidden, and Open Transport initializes with the default configurations. Should the system switch back to classic networking at a later time, Open Transport settings are hidden and the saved classic settings are restored.

Each time the system switches between classic and Open Transport - whether through the use of the Network Software Selector utility or by moving an external boot volume from system to system (where different memory sizes or processor types could cause a switch) - this process will be repeated.

Note that after the initial installation, there is no exchange of configuration information between classic and Open Transport networking. If changes are made in network addressing, and so on while running classic networking, those changes will not be in effect up on switching back to Open Transport. The inverse holds true as well.

For AppleTalk users this would very rarely be any sort of problem, as AppleTalk dynamic addressing and dynamic naming would typically adjust to the system environment at network initialization time.

For TCP/IP users, this could create the potential for some confusion if a user installed Open Transport but continued to run classic networking for a while -- making some configuration changes during that time. Later, when they enable Open Transport networking using the Network Software Selector utility, they'll find that the default Open Transport/TCP configuration reflects their "old" MacTCP settings, not the most recent version.

While there is some potential confusion for users in this behavior, Apple looked carefully at the alternatives, including the possibility of converting information every time the stored preference for network system changed. That approach would have resulted in more frequent and more difficult end-user problems, so was abandoned in favor of the single-conversion at installation time.

Question: On systems that support both classic and Open Transport networking, how are control panels managed? How does the Network Software Selector interact with these files?

Answer: During the boot process, a MacOS system running System 7.5.3 checks for the stored preference for networking software as described above. Once the selection of network software has been determined and validated, the load process also causes the appropriate control panels -- "Network" and "MacTCP" for classic networking; "AppleTalk" and "TCP/IP" for Open Transport -- to be "unhidden". Those associated with the disabled network software are hidden (made invisible).

For the Network Software Selector "show and hide" mechanism to work, it is very important that all files associated with networking be stored in their original and proper locations, with their original file names. Users should not rename these files, nor should they partially install or de-install networking software by dragging copies of files into or out of the System Folder.

Question: Does the Network Software Selector allow running Open Transport on a 68000 or 68020 Mac? If not, why not?

Answer: While NSS can change the stored preference to Open Transport at any time, the preference will be honored at boot time only on those models that can use Open Transport - 68030, 68040, and PowerPC MacOS systems.

68000 and 68020 systems always load and run classic networking. Open Transport was not engineered to support these two older processors as the overall processor and system memory requirements associated with Open Transport's additional features are generally higher than that available in these older systems.

Question: Does the Network Software Selector allow running classic networking on a PCI Power Mac? If not, why not?

Answer: While NSS can change the stored preference to classic networking at any time, that preference will be honored at boot time only on those models that can use classic - 68030, 68040, and NuBus PowerPC MacOS systems.

However, certain MacOS systems with PCI - designed for entry-level markets, where users' networking needs and system memory configurations may be limited - may ship with a default preference to initially support only AppleTalk on LocalTalk using classic networking. On these systems, a user can easily enable Open Transport using NSS when they are ready to take advantage of PCI network

cards, or when they want to gain direct access to TCP/IP networks such as the Internet.

Classic networking is not generally supported on PCI MacOS systems for a number of reasons:

- PCI MacOS systems are based on PowerPC, and only Open Transport provides PowerPC native code;
- Apple simultaneously adopted hardware and software standards for networking by supporting PCI networking via Open Transport's DataLink Provider Interface (DLPI) driver architecture;
- Many of the new features provided by Open Transport, such as multiple saved configurations, reconfiguration without restart, and support for current standards (DHCP, IP multicast, and so on) would have been technically difficult or impossible to retrofit to classic networking; and,
- Open Transport prepares the way for the Copland release of MacOS, by carefully defining an execution model consistent with protected memory and preemptive scheduling.

Question: Can MacTCP be installed on a system running Open Transport?

Answer: With System 7.5.2 it was possible - although not recommended or supported - to install MacTCP on PCI MacOS systems through drag-copy of specific files. Beginning with System 7.5.3, this is no longer possible.

In order to meet the requirements of the Universal System Folder, System 7.5.3 automatically hides files associated with classic networking on systems where Open Transport is in effect (and correspondingly hides Open Transport files on systems where classic networking is running). If a user installs MacTCP on a PCI machine - where Open Transport is always active - the "just installed" MacTCP files will be automatically be hidden by the MacOS immediately upon reboot of the system. This could be confusing to users who may not be aware that this software configuration (MacTCP on PCI machines) is not supported.

If, for any reason, it becomes necessary to reinstall MacTCP on a 68030, 68040, or NuBus PowerPC MacOS system running Open Transport, the end-user must first use the Network Software Selector utility to specify a preference for classic networking and reboot the system. Only after the reboot will MacTCP and the other components of classic networking be visible. The converse would also be true for Open Transport on these machines - only the currently running network system is visible and can be modified or updated.

Question: Does System 7.1.x support both classic and Open Transport networking?

Answer: System 7.1.x continues to support classic networking, and gains the option of running Open Transport v1.1.

Customers running 7.1.x on 68000 and 68020 systems will continue to use classic networking; Open Transport v1.1 will not install on these systems. (System 7.1.x does not support PCI MacOS systems.) Customers running System 7.1.x on 68030, 68040, and NuBus PowerPC MacOS systems can use either classic or Open Transport networking. To enable Open Transport, users must run the Open Transport installer, available as a part of the stand-alone retail distribution package.

Question: Is the Network Software Selector available for System 7.1.x customers?

Answer: No, the Network Software Selector is a feature only found in System 7.5.3.

Article Change History:

23 Oct 1996 - Changed distribution status.

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