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Technical Note HW09

Macintosh IIx: The Inside Story

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This Technical Note addresses various areas of potential incompatibilities with the Macintosh IIx and current software applications and provides information about some of Apple's compatibility software updates.

[Feb 01 1991]

What's Inside

On the Macintosh IIx, the CPU no longer handles I/O operations like floppy disk access, SCC access, and mouse events. Instead of the CPU doing all of the work, the IIx contains a couple of separate I/O processors, Apple custom ASICs, to handle all floppy disk, mouse, and SCC I/O. With the advent of these new I/O processors (IOP), the IIx can handle smooth cursor movement and time consuming disk operations simultaneously. These new IOPs are just an example of the new capability of this machine.

Each of the following sections talks about the changes and added functionality which makes life difficult for some types of applications. The IOPs in the IIx cause some applications problems, and this Note shows why certain techniques no longer work and provides solutions to work around these incompatibilities where possible. A few additional sections provide

information about updated System Software or peripheral software from Apple which the Ilfx requires for operation.

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ADB

Applications which depend upon direct access to the ADB transceiver or its VIA registers do not work with the Ilfx, because the IOP which now handles ADB is not available for direct access. As in the past, the hardware is subject to change, and applications which access it directly break when new hardware is introduced. There is no solution for applications which try to directly access the ADB hardware; these applications must now use the ADB Manager or they cannot run on the Ilfx and future Macintosh models.

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CD-ROM Driver

To use the AppleCD SC with a Macintosh Ilfx (and Ilci), you must use version 3.0.1 or later of the [Apple CD-ROM](#) drivers. Earlier versions of this driver are incompatible with this hardware. You can obtain a copy of this driver from any authorized Apple dealer, the Developer CD Series, AppleLink (Developer Services: Macintosh Developer Technical Support: Peripheral Software), and the Apple FTP site on the Internet (Apple.COM under ~ftp/pub/dts/sw.license/).

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EtherTalk Driver (.ENET)

To use the Apple EtherTalk card with a Macintosh Ilfx, you should use version 2.0.2 of the EtherTalk driver. Earlier versions of this driver do not perform as well with this hardware. You can obtain a copy of this driver from any authorized Apple dealer, the Developer CD Series, AppleLink (Developer Services: Macintosh Developer Technical Support: Peripheral Software), and the Apple FTP site on the Internet (Apple.COM under ~ftp/pub/dts/sw.license/).

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MacsBug

To use MacsBug with a Macintosh Ilfx, you must use version 6.2. Earlier versions of MacsBug are incompatible with this hardware. You can obtain a copy of MacsBug 6.2 from APDA, the Developer CD Series, and AppleLink (Developer Services: Macintosh Developer Technical Support: Tools: MacsBug).

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NuBus

If the Macintosh Ilfx executes a Read-Modify-Write NuBus(TM) code sequence to a card (i.e., TAS or test and set) and immediately follows it with a regular cycle Read or Write, the system hangs. The solution to this problem is to execute five NOP instructions between the TAS and the next cycle. This number of NOP instructions should also handle future accelerations of the CPU clock, should Apple decide to further accelerate it.

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SADE MultiFinder

To use SADE with a Macintosh Ilfx, you must use version 6.1b9 of MultiFinder with the Set Aside feature. Earlier versions of MultiFinder are incompatible with SADE on this hardware. You can obtain a copy of MultiFinder 6.1b9 from APDA with SADE 1.1, the Developer CD Series, and AppleLink (Developer Services: Macintosh Developer Technical Support: Tools: SADE MultiFinder). Developers may **not** distribute MultiFinder 6.1bx to customers, even if licensed to distribute Apple's Macintosh System Software.

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SCC

Like the processor which controls floppy disk and ADB I/O, the IIx has another ASIC to control the SCC, but unlike the former, this processor is capable of running in a special "IOP Bypass" mode which allows direct access to the SCC.

The new SCC architecture also contains a few other differences from the previous architecture. On the IIx, there is no longer a VIA line available for monitoring the Wait/Request signal of the SCC. Applications which depend upon this bit have no solution to this problem and are incompatible with the IIx. In addition, on the IIx the vSync bit (which has been available since the Macintosh SE) has moved to a new location; however, Apple is providing developers with a trap call (`_HWPriv`) which allows applications to enable or disable this bit in its new location, thereby providing a solution for applications which depend upon this bit. For more information on this trap call, see the vSync Bit section later in this Note. Technical Note #261, *Cache As Cache Can*, also addresses `_HWPriv`.

IIx Serial Switch cdev

If an application requires direct access to the SCC, then you should license the IIx Serial Switch cdev from Apple Software Licensing. The native mode of the IIx uses a special processor to handle all SCC work, thus increasing overall machine performance by offloading this task from the CPU. However, applications must sacrifice direct SCC access for this performance gain. The IIx Serial Switch cdev allows applications which must directly access the SCC to bypass the processor while sacrificing the increased performance.

This cdev sets a bit in parameter RAM which the IIx checks during startup. If "Faster" mode is chosen (default), then the IIx uses the special processor, but if "Compatibility" mode is chosen, then the IIx lets the CPU handle SCC processing, which allows direct access. To license this cdev, contact:

Apple Software Licensing
Apple Computer, Inc.
20525 Mariani Avenue, M/S 38-I
Cupertino, CA 95014
(408) 974-4667
AppleLink: Sw.License
Internet: Sw.License@AppleLink.Apple.com

There is no way for an application to determine in which mode it is running; therefore, if the machine is in "Faster" mode and an application attempts a direct call to the SCC, the machine crashes.

Wait/Request Bit

On previous Macintosh models, there is a Wait/Request bit on the VIA1 register A for monitoring incoming serial data while the Macintosh is busy with some other operation. When the SCC receives a character, it sets this bit in the VIA, which tells the operating system that the SCC needs attention. Since the IIx has a dedicated processor for SCC transactions, it has no need for this mechanism. Even if a machine is using the IOP Bypass mode to directly access the SCC, this line is not active, so applications which rely upon it are incompatible with the IIx. For more information about this bit, refer to the *Guide to the Macintosh Family Hardware*, Second Edition.

vSync Bit

The `_HWPriv` (\$A198, selector 7) routine enables or disables external SCC clocking. The external clock comes to the SCC through the RTxC signal, which is connected to the GPI pin on the serial port connector. This routine is used instead of writing directly to the vSync bit on VIA1 (which is not implemented on the IIx), and it is backpatched into all previous CPUs, except the Macintosh Plus, which does not support external clocking. `_HWPriv` only works in IOP Bypass mode on the IIx, and is documented below for your convenience:

```

Entry:
    d0.l = routine selector = 7
    a0.l = <port number>.w <enable/disable ext clock>.w
           23-16: port number 0 = port A, 1 = port B,... for future expansion
           15-0 : 0 = internal clocking, 1 = external clocking
Exit:
    d0.l = zero if good, -1 if error
    a0.l = <port number>.w <last state of external clock>.w

```

Synchronous SCC I/O

If an application expects to make synchronous SCC I/O calls with interrupts turned off, it does not work on the IIx, because the new IOP serial driver uses the Deferred Task Manager, which is interrupt driven. If an application tries to do something like communicate with the IOP SCC driver when interrupts are turned off, the IIx hangs.

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SCSI

The Macintosh IIx may cause developers problems in two areas which deal with the SCSI interface. The first are the SCSI low-memory globals. A few applications rely upon undocumented low-memory globals which point to addresses in the SCSI controller chip; however, on the Macintosh IIx, these globals now point to an entirely different area. If an application depends upon these globals, it either does nothing or crashes on the IIx. The second problem deals with SCSI termination. For more information about SCSI termination on the Macintosh IIx and how it differs from previous Macintosh models, refer to Technical Note #273, SCSI Termination.

In addition, although the IIx hardware has SCSI DMA capability, the Macintosh System Software does not yet take advantage of it. Apple recommends that you wait until the Macintosh System Software implements support for the IIx SCSI DMA to use this hardware feature.

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SWIM

On the IIx, the floppy disk controller, the SWIM, is not directly accessible; instead, the IIx has a processor which handles all floppy drive access. This processor, an Apple custom ASIC, is not accessible to third-party developers. The I/O processing hardware is subject to change, and applications which attempt to access it directly are likely to break when new hardware is introduced.

Apple has always recommended against direct hardware access, but some applications do it anyway, and these applications now have problems with the new IIx hardware. The most common reason these applications access the hardware directly is to move hidden information to and from the disk. As a partial solution to this problem, the IIx includes a new version of the Sony driver which allows applications to make a control call to get raw data from the disk. For more information on this new driver and control call, refer to Technical Note #272, [What Your Sony Drives For You](#).

Asynchronous Disk I/O

If an application expects to make asynchronous I/O calls to the Sony driver with interrupts turned off, it does not work on the IIx, because the new IOP drivers are interrupt driven. If an application tries to do something like open a resource when interrupts are turned off, the IIx hangs.

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VIA2

All of the functionality of VIA2 has been moved to other chips in Macintosh IIx, so if an application depends on VIA2 registers, it must find a different way to get the information for which it is looking to be compatible with the IIx.

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This is What Makes a "Wicked Fast" Macintosh

The basic message of this Note is that if developers directly access Macintosh hardware, their applications are likely to break on new hardware like the Macintosh IIx. If an application is having compatibility problems with the IIx, they are probably due to one of these documented changes, and this Note should help provide the necessary solutions where they are available. If an application is having compatibility problems with the IIx and they are not related to one of these areas, then qualified developers should contact Developer Technical Support for help in tracking down the problem.

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References

Guide to the Macintosh Family Hardware, Second Edition

Inside Macintosh, Volume V, Compatibility Guidelines

Inside Macintosh, Volume V, Deferred Task Manager

Technical Note M.OV.Compatibility-- [Compatibility Guidelines](#)

Technical Note M.OV.Compatibility -- [Compatibility: Why and How](#)

Technical Note M.OV.GestaltSysenvirons -- [_SysEnvirons: System 6.0 and Beyond](#)

Technical Note M.HW.Cache -- [Cache as Cache Can.](#)

Technical Note M.DV.SonyDriver -- [What Your Sony Drives For You.](#)

Technical Note M.DV.SCSITermination -- [SCSI Termination](#)

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