Macintosh II: NuBus capabilities

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TOPIC -----

The Macintosh II includes six NuBus slots to provide expansion capabilities for the computer. These slots may be used for video output, processors and coprocessors, terminal devices, and serial and parallel devices, among other uses.

DISCUSSION -----

The logic board's 68020 communicates with each of the six synchronous NuBus slots through the memory management unit. A full 32-bit address/data transfer is available between each slot and the 68020. Each slot is identified to the microprocessor by four ID lines, which the 68020 uses to determine the source of the communication. Power, timing, acknowledge, and parity lines are also implemented. Apple has changed Texas Instruments' NuBus definition by adding an interrupt line from each slot, so that each card can generate an interrupt to the 68020.

The 32-bit address space (equating to 4G bytes) available for all NuBus slots is partitioned to provide space for each slot. First, the top 256M of address space is divided into 16 "slots." This allows each physical slot to "own" 16M, which is referred to as its Slot Space. Each NuBus slot is also allocated 256M of "SuperSlot Space" from the portion of memory remaining in the 4G of address space.

Each NuBus card should contain a configuration ROM mapped to the top of its Slot Space to provide information for the Macintosh II operating system at startup time. The Macintosh II looks at the ROM to determine the type of card, how it is to be accessed, and slot resource data.

Pre-defined card categories include display, network, terminal emulator, serial, parallel, intelligent bus, and human input devices. Each category is further defined by a type indicator. For example, the network category is subdivided into AppleTalk, EtherNet, Token Ring and so on. NuBus device drivers can then locate any appropriate card by checking these bytes in configuration ROM on each card.

NuBus cards can be designed to be "masters" of the bus, or as slaves only. A master card must be able to initiate bus transfers of 8, 16, or 32 bits, and must be able to arbitrate requests for bus mastership. It may include the ability to lock the bus from access by other NuBus devices for a specified period of time. A slave card responds to requests, but can only send a "non-master request." It need not support the full 32-bit transfer.

Card manufacturers may choose to implement a NuBus card with only a 24-bit logical address mode to provide compatibility with existing Macintosh products. This mode is supported by using only address lines 0 through 23, and is called "24-bit aliasing."

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