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## NuBus, MicroChannel, And EISA: Questions And Answers

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### TOPIC -----

Here are some questions and answers about Apple's NuBus versus IBM's MicroChannel Architecture and the proposed Extended Industry Standard Architecture (EISA):

### DISCUSSION -----

#### MULTIMASTERING

Q) How many coprocessor cards can NuBus support?

A) Any single NuBus card can be the Master (a card that initiates the addressing of another card) at any time. This action can be passed from card to card. Because of Apple's implementation of six slots, only six NuBus master cards can be supported in the Macintosh II.

NuBus itself can utilize an arbitrary number of slots, based on the designated size of each slot. The upper one-sixteenth of the total address space is available for slot space. This provides 256MB of addressing. Apple provides six slots of 1MB each in 24-bit mode. In the 32-bit mode, there are 16 possible slots on the Macintosh II, with an address space of 16MB each.

#### PERFORMANCE

Q) Can NuBus support processor speeds up to 25 MHz? 33 MHz? 45 MHz?

A) Cards can maintain their internal clock up to any possible speed. There are no set limitations for a card's internal clocks. Limitation are

imposed by NuBus transactions. NuBus is clocked at 10 MHz.

#### ADDRESS SPACE

Q) Is NuBus hardwired at 24 address lines?

A) NuBus is not hardwired at 24 address lines. It is a full 32-bit bus. The 24-bit addressing mode is a software-controlled mode imposed for compatibility with the 24-bit addressing System 6.

#### MEMORY

Q) What's the maximum amount of memory addressable through today's NuBus?

A) The maximum amount of memory addressable on the NuBus is 4 gigabytes. This is the total addressable range at 32 bits. On the Macintosh II, ROM space is reserved for 1MB of space. RAM is reserved for 1 gigabyte. Additionally, the NuBus slot address space includes a super slot space of 1.536 gigabytes allocated to the six slots for 256MB per slot and a slot space of 256MB allocated for 16 slots at 16MB each.

The breakdown is:

Memory: ROM, RAM, and slot space

ROM:	1MB
RAM:	1000MB
Super Slot:	1536MB
Slot:	256MB
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Total:	2793MB

Q) How much memory can be added on a card or the motherboard?

A) The NuBus will access up to 16MB of RAM on a card in slot space and 256MB of RAM in Super Slot space. The maximum direct addressable range through the Macintosh OS is currently 1MB per card.

The full address range (up to 256MB) can be addressed by NuBus or by page flipping the memory on the card. The Macintosh II motherboard physically can connect 8MB. The maximum possible when looking at the NuBus and reserved memory addresses is 1 gigabyte.

#### DMA

Q) What are the DMA capabilities of NuBus?

A) DMA is not supported across NuBus.

NuBus-to-Macintosh II Address Mapping

24-bit Addresses from MC68020	32-bit Addresses from MC68020	NuBus Addresses	Used To Access Macintosh II Sys
\$xx00 0000 to \$xx7F FFFF	\$0000 0000 to \$007F FFFF	\$0000 0000 to \$007F FFFF	Present RAM
	\$0080 0000 to \$3FFF FFFF	\$0080 0000 to \$3FFF FFFF	Future RAM
\$xx80 0000 to \$xx8F FFFF	\$4000 0000 to \$4FFF FFFF	\$F080 0000 to \$F0FF FFFF	ROM (aliased)
\$xxF0 0000 to \$xxFF FFFF to	\$5000 0000 to \$5FFF FFFF	\$F000 0000 to \$F070 FFFF	I/O (aliased); do not access from a slot card
	\$6000 0000 to \$8FFF FFFF	\$60000 0000 to \$8FFF FFFF	Presently unused
	\$9000 0000 to \$EFFF FFFF	\$9000 0000 to \$EFFF FFFF	Super slot space, slots \$9 to \$E
\$xxF0 0000 to \$xxFF FFFF	\$F000 0000 to \$F0FF FFFF	\$F000 0000 to \$F0FF FFFF	Slot \$0 (Macintosh system)
	\$F100 0000 to \$F8FF FFFF	\$F100 0000 to \$F8FF FFFF	Presently unused
\$xxs0 0000 to \$xxsF FFFF	\$Fs00 0000 to \$FsFF FFFF or \$Fs10 0000 to \$FsFF FFFF	\$Fs00 0000 to \$FsFF FFFF or \$Fs10 0000 to \$FsFF FFFF	Slot space, slot s (s in range \$9-\$E)
	\$FF00 0000 to \$FFFF FFFF to	\$FF00 0000 to \$FFFF FFFF	Presently unused

FOR MORE INFORMATION

Check "Designing Cards and Drivers for Macintosh II and Macintosh SE" (ISBN #0-201-19256-X) from Addison-Wesley; mechanical drawing of cards and connectors available from APDA; and NuBus patent licenses from Texas Instruments, Inc.

To locate a vendor's address and phone numbers, use the vendor name as a search string.

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