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I/O Card Slots: Descriptions (3/95)

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TOPIC -----

This article reviews the basic features of popular card slot standards in the Macintosh and Intel computer architectures.

DISCUSSION -----

NuBus
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A standard designed by Texas Instruments; later updated to NuBus90. It features self-configuration and bus-mastering on a 32 data bit card. Bus-mastering means a card can take control of the bus, which allows for multi-processor computing. The card self configures using on-board ROM (Read Only Memory).

The card slot is a one-piece socket (female) connector with two rows of pins. The card has a plug (male) connector that plugs into the socket. This slot type is not compatible with any other slot standard.

Bus Clock - 10MHz (20MHz, card to card only using NuBus90)
Data Path - 32 Bits (often limited to 24 bits for OS compatibility with older Macintosh computers)
Max data transfer rate - 10 MB/sec, 37 MB/sec with Burst Mode

ISA-Industry Standard Architecture
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The basic, most popular card slot in Intel-powered machines. First introduced in the IBM-AT as an improvement over the 8-bit slots in the IBM-XT. The ISA card slot looks something like a two part socket. The left part is the same as the original IBM-XT slot with an additional slot to the right for the new AT signals.

Bus Clock - 8.33 MHz standard (faster available from some vendors)
Data Path - 16 Bits
Max data transfer rate - 8.33 MB/sec

EISA-Extended Industry Standard Architecture

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This is the next generation of the IBM-AT card slot. Two new standards emerged around this time, EISA and MCA. EISA provides a 32 bit data path and bus-mastering capability. Its data transfer rate is further increased by 32 bit DMA transfer and burst cycles. It is fully compatible with ISA cards as well. Cards auto-configure themselves using the EISA configuration utility. The slot is the same size and shape as an ISA slot but has a "two tiered" row of contacts for a total of 188.

Bus Clock - 8.33 MHz standard
Data Path - 32 Bits
Max data transfer rate - 33 MB/sec (using all optional EISA features)

MCA-MicroChannel

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This is the next generation of the IBM-AT card slot from IBM. Two new standards emerged around this time, EISA and MCA. MCA provides a 32-bit data path and bus-mastering capability with priorities. Its data transfer rate is further increased by 32-bit DMA transfer and burst mode. Cards auto-configure themselves using a configuration utility. It does not differ radically from the EISA standard in capability as implemented in CISC based computers, although the card slot is incompatible. RISC systems from IBM (RS6000) have additional hardware signals on the card slot, which enables much faster data transfers. These slots are not compatible with any previous card slot standard.

There are different formats of the MCA card slot depending on the vendor's implementation of various slot extensions. The extensions are associated with the number of bits enabled for data transfer. There is an 8, 16, and 32 bit variety of a card with additional extensions for video expansion and matched memory expansion.

Bus Clock - 10 MHz standard
Data Path - 32 Bits
Max data transfer rate - 20 MB/sec, (160 MB/sec in RS6000 machines)

PCI-Peripheral Component Interconnect

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This is one of two card slot standards that implement the Local Bus standard (the other is VL Bus). PCI was developed by Intel as the next generation beyond MCA and EISA. It operates with 32 data bits at a faster clock rate than previous standards. A 64 data-bit expansion to the standard is planned. This card

multiplexes the address and data lines on the card for fewer pins at a slight speed penalty. PCI card slots are similar to MCA slots and are not compatible with other slots. These cards are auto configured by the BIOS of the host system.

Bus Clock - 33 MHz standard

Data Path - 32 Bits

Max data transfer rate - 66 MB/sec, 120 MB/sec with Burst Mode

VL Bus

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The product of the VESA standard committee. The VL Bus is an alternative implementation of the Local Bus standard. It features 32-bit data transfer (with a planned upgrade to 64) at the CPU clock speed (maximum 66MHz). The boards typically run at a maximum of 40MHz. VL Bus cards can be designed as Local Bus Masters or Local Bus Targets. Local Bus Masters can take control of the bus.

This card slot is a standard ISA slot with an additional, in-line socket that contains the VL Bus signals. This makes this slot ISA (and EISA) compatible. A VL Bus machine typically has up to three VL Bus slots in it. These cards are auto configured by the BIOS of the host system.

Bus Clock - CPU clock speed with a 66MHz maximum. Typical design is 40MHz
Data Path - 32 Bits

Max data transfer rate - 66 MB/sec, 120 MB/sec with Burst Mode (@33MHz)

Article Change History:

16 Mar 1995 - Corrected name of PCI bus.

08 Feb 1995 - Added keyword; made several technical updates.

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