PCI Expansion Bus Architecture Description (9/95)

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TOPIC ----------

This article contains basic information about Peripheral Component Interconnect (PCI), why Apple is incorporating PCI into its new machines, a comparison of PCI with NuBus, and answers to some commonly asked questions.

DISCUSSION ----------

What is PCI?

PCI (Peripheral Component Interconnect) is a high-performance expansion bus architecture that was originally developed by Intel to replace the traditional Industry Standard Architecture (ISA) and Enhanced Industry Standard Architecture (EISA) buses found in many 80x86-based PCs.

To promote its widespread acceptance, Intel turned the specification over to a broad-based committee of industry leaders whose function is to define and market PCI. This committee consists of 12 voting members, 11 of whom are elected on an annual basis, with Intel retaining a permanent voting position. Apple is currently a voting member.

Turning the PCI specification over to a committee opened it up for free licensing and use by any vendor. Vendors have responded with enthusiasm. Currently, more than 200 vendors are producing PCI cards, and more than 500 cards are available for this bus architecture.

Why is Apple moving to PCI?

PCI is a computer industry standard. By moving to PCI, Apple continues to demonstrate its commitment to "fitting in" in the industry. The majority of personal computers based on 80486 or Pentium processors already incorporate the PCI architecture. Apple's adoption of PCI for its new Power Macintosh computers and Workgroup Servers will support and strengthen the specification's status as

a standard in the industry. And, in the future, PowerPC processor–based computers from IBM and Motorola will also use this bus architecture. Apple's full implementation of the PCI 2.0 specification lets any existing PCI 2.0 compliant card work in an Apple computer when combined with a software diver specific to the Mac OS.

Going with an industry standard provides a number of benefits. Because Apple fully implemented the PCI 2.0 specification, in conjunction with a software driver specific to the Mac OS, any existing PCI 2.0-compliant card will work in an Apple computer with PCI. This compatibility gives users of Power Macintosh and Workgroup Server systems with PCI slots access to the many PCI cards available today. It also enlarges the potential market for PCI cards, which should both encourage their future proliferation and drive their cost down further.

In addition, the PCI bus will allow Apple to use more industry-standard components in the future, which will make Power Macintosh computers and Workgroup Servers even more affordable.

PCI provides high performance. PCI offers significantly higher performance than NuBus, the bus architecture used in previous Macintosh models. More specifically, a PCI card can provide performance up to three times faster than that of a similar card on even the fastest computers with NuBus slots.

PCI is a very scalable technology and will offer further performance gains in the future. Plans for extending the bus include support for 64-bit extensions and a higher clock speed across the bus.

PCI on a Power Macintosh or Workgroup Server will provide outstanding performance, made possible because these computers are designed with performance in mind. More specifically, the fact that these systems contain only PCI slots allows Apple to take full advantage of the power of the RISC (Reduced Instruction Set Computing) architecture, enabling all PCI cards to run at the maximum speed of 33 megahertz. In contrast, many 80x86-based PCs offer mixed slots, which run at a range of speeds.

PCI promotes new solutions. PCI will also attract new solutions to the Power Macintosh platform. Developers of specialized cards who found the NuBus market too small or the technical side of developing for NuBus too complex will find it easy to adapt their products for Power Macintosh computers with PCI. Instead of a massive hardware and software effort to move to Macintosh, these developers will be able to take their existing PCI hardware and simply add a Mac OS specific software driver.

PCI and NuBus: A comparison

The following chart/table provides a feature-by-feature comparison between the PCI and NuBus specifications:

Begin_Table

	PCI	NuBus
Bus Speed	33 MHz	10 MHz

Theoretical Maximum Throughput	132 MB per second	40 MB per second
Maximum Number of Slots	4 per bridge; 256 bridges	6 per bridge; 14 bridges
Real Throughput	90 MB per second writes; 45 MB per second reads	32 MB per second writes; 20 MB per second reads
Software	Name Registry, Open Firmware	Slot Manager
Form Factor	12.283 in. and 6.875 in.	12 in. and 7 in.

End_Table

One point that is especially significant is the change in software that the move to PCI represents. All Apple computers with PCI will have built-in Open Firmware software, which is a standard (IEEE 1275) for booting PCI cards in an OS-independent environment. Using Open Firmware gives Apple flexibility in its choice of future operating systems.

Finally, the runtime environment for PCI cards is also being rewritten to allow for growth in the future. The new expansion manager will allow PowerPC and 80x86 drivers to coexist in the PCI cards' ROM. This ability to accommodate multiple drivers permits the performance of I/O activities conducted via cards to improve significantly in the future.

Questions and Answers

Question: Can NuBus cards be used in an Apple computer with PCI slots?

Answer: Yes. To preserve customer investments in NuBus technology, a NuBus expansion chassis for PCI will be available from a third-party. This chassis will enable users to continue to use their existing NuBus cards in Power Macintosh computers and Workgroup Servers with PCI, if they so choose.

However, because PCI offers both higher performance and more solutions, we anticipate that users will embrace the new bus technology. In addition, the built-in graphics acceleration capabilities of the new Power Macintosh computers should allow these systems to meet the needs of many customers without the addition of an acceleration card.

Question: Can any PCI card be used in a Power Macintosh computer or Workgroup Server with PCI?

Answer: Yes. However, a Mac OS-, NetWare-, or AIX-specific software driver is required for each card. Many manufacturers of existing PCI cards have already committed to producing these drivers.

Question: What kind of industry support exists for PCI on the Power Macintosh?

Answer: A number of companies in both the United States and Europe have committed to producing PCI cards for the Power Macintosh. These companies include Apple, Adaptec, Asanté, ATI, ATTO, Data Translations, Diamond Multimedia, DPT, Farallon, FWB, Hermstedt GmbH, Interphase, Matrox, MicroNet, miro, National Instruments, Neutral, Orange Micro, Precision Digital Images, Q-Logic, Rockwell, Second Wave, Spectra Systems, and Yarc.

Question: What PCI cards will Apple provide?

Answer: Apple will provide several PCI networking cards, including the Apple PCI Ethernet 100BaseTX Card, Apple PCI Token Ring Card, Apple PCI Ethernet Twisted-Pair Card, and Apple PCI Ethernet Thin Coax Card.

Question: Will Apple's move to PCI be reflected across its product lines?

Answer: Yes. Apple will offer PCI not only in desktop systems and Workgroup Servers, but also in PowerBook notebook computers.

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