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Link

Lava I/O News

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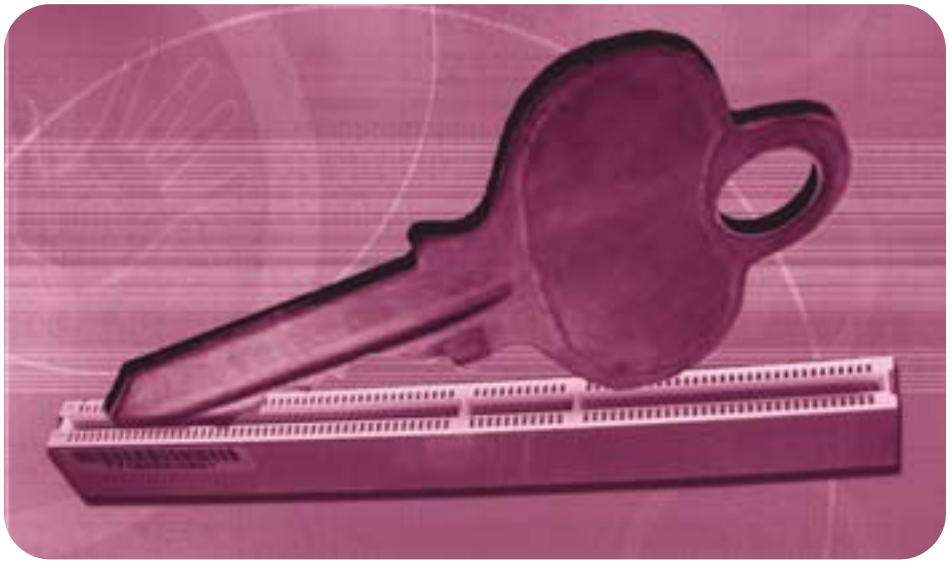
Keying into PCI



The PCI (Peripheral Component Interconnect) bus has been the most successful bus technology in computer history. Most PC users are familiar with PCI from adding cards onto its bus connectors, found on almost any motherboard.When it was introduced in 1992, PCI filled an immediate need for a bus with greater capabilities than those of the ISA bus. What is only now becoming clear to many people is the degree to which the PCI bus was capable from its inception of growing to meet future demands.

The designers of the PCI bus realized early on that for their technology to have longevity it would need to grow painlessly.To accomplish this, they designed the PCI specification with clear paths for its technological evolution, notably in both its electrical signaling, and in the width of the bus that PCI would be able provide to add-in boards and peripherals.The paths for this technological growth are clearly visible when looking at PCI connectors and add-in cards.

As well, the PCI specification has redefined connectors and add-in cards with the sole purpose of making physically smaller systems.

As a group, these changes to the technology and keying system used for PCI cards and connectors are major factors in PCI's flexibility, longevity, and overall success.

PCI 2.2 and 3.3 Volt Signaling Technology

As early as PCI Revision 2.1 in 1995, the designers of the PCI specification realized that signaling technology would evolve from a 5 volt signaling environment to a 3.3 volt environment.This awareness led to designing PCI as an evolutionary path from a 5 volt to 3.3 volt signaling environment, without forcing vendors to make the change by necessarily buying more expensive 3.3 volt components that could also handle 5 volt signals.

To this end,the PCI Special Interest Group (PCI SIG) designed the "5V to 3.3V Transition Roadmap." This roadmap involved specifying connectors and add-in cards in a way that distinguished between a given *signaling environment* and a given *component technology*. The design allowed vendors to choose components independently of signaling environment. This was accomplished with three add-in board types: 5 volt expansion boards that would operate exclusively in a 5 volt signaling environment, 3.3 volt boards that would operate exclusively in a 3.3 volt signaling environment,and a third board type, the Universal expansion board, that would operate in either.Complementary connectors for 5 volt and 3.3 volt signaling were also specified. Since signaling environments cannot be mixed,no "universal connector" exists.

As the PCI specification evolves from Revision 2.0 to Revision 3.0, it explicitly encourages migration from 5 to 3.3 volt signaling, but

Evolution of the PCI Specification

PCI Revision	Date	Significant Changes to Mechanical Features
PCI 1.0	June 22, 1992	
PCI 2.0	April 30, 1993	• added connector and add-in card specification
PCI 2.1	June 1, 1995	
PCI 2.2	December 18, 1998	• incorporated riser ECN • incorporated low profile PCI ECN
PCI 2.3	March 29, 2002	• deleted 5 volt only keyed add-in boards
PCI 3.0	August 12, 2002	• removed support for 5 volt keyed system board connectors

without demanding a quantum jump on the part of users or vendors. The path of this migration shows in how support for connectors and add-in boards changes from one revision of the specification to the next. PCI 2.1 and 2.2 both define six add-in card configurations, with support for 5, 3.3, and Universal (3.3/5 volt) signaling in both 32-bit and 64-bit bit variants. Each card type is designed with notches, and each connector type is designed with ridges, so that cards can "key" with compatible connectors only.

PCI Revision 2.3 removes 5-volt-only cards from the specification, but retains the 5-volt-only motherboard connector. As well, when PCI Revision 2.3 incorporated the Low Profile PCI Engineering Change Notice into the specification, it specified that low profile PCI cards would use 3.3 volt signaling exclusively.

PCI SIG has recently completed review of the PCI Revision 3.0 draft specification. This bus specification will extend the widely-used PCI 2.x specifications, and continue the evolution toward lower-voltage bus signaling technology. With it, the PCI standard will remove support for 5 volt signaling on connectors. However, before you feel you should start throwing out 5 volt PCI cards, it should be noted that at this time the PCI 3.0 Revision explicitly *does not* supercede Revision 2.3, which *does* include 5 volt keyed PCI connectors.

32-Bit and 64-Bit PCI Cards

At the same time as the PCI SIG was developing its roadmap moving to 3.3 volt signaling, they also foresaw that one day a 32-bit data bus would be too narrow. With this in mind, they specified both 32-bit and 64-bit PCI connectors and add-in cards. After 10 years, the traditional and familiar 32-bit PCI connector is just now starting to be replaced with 64-bit connectors on systems such as servers and high-end systems that need a yet higher-bandwidth expansion bus.

Fortunately, the 64-bit interface remains flexible for those with 32-bit add-in cards. A 32-bit card will fit into a 64-bit connector, and work properly. In addition, a 64-bit card will fit into a 32-bit connector, and configure for 32-bit transfers. In this case, a portion of the 64-bit card simply hangs off the end of the 32-bit connector.

Riser Cards and Low Profile PCI Cards

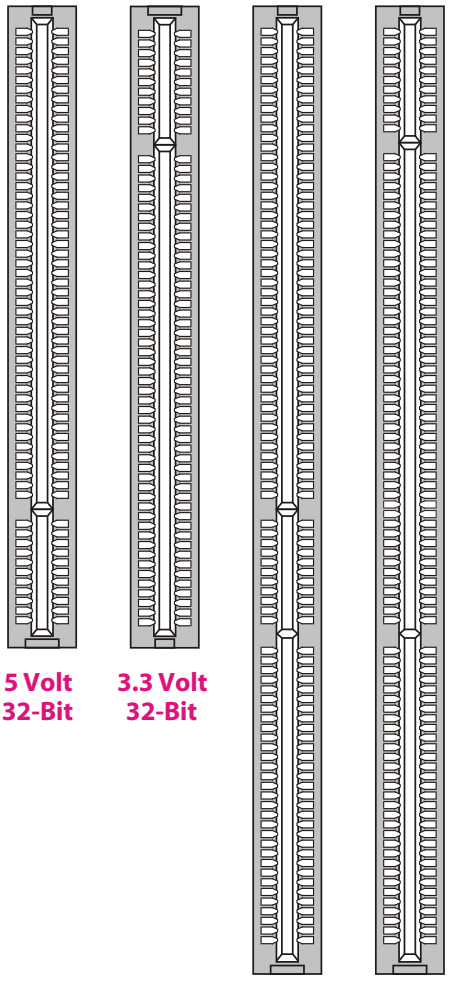
With the growth of the Internet, and in line with increased demand for centralized computing, the need for high-density server clusters became apparent. Component sizes were generally falling, and yet the PCI specification had defined maximum card heights in harmony with the old ISA standard. Minimum card heights could be as little as 1.42", but that height left little space for components. Besides, the bracket was the same height it had always been. As systems moved to rack-mount configurations, the PCI card needed to evolve to allow rack-mounted PCs to fit the 1U and 2U form factors.

PCI Revision 2.2 incorporated two Engineering Change Notices that made this possible. One ECN instituted the Low Profile PCI standard, which reduced the minimum card height to 0.945" and simultaneously reduced the height of the add-in card bracket from 4.725" to 3.118". For systems that needed larger cards or still lower-profile form factors, a second ECN defined riser cards, cards that fit vertically into a PCI connector and in turn would allow a standard PCI add-in card to assume a horizontal orientation.

5 Volt PCI Phaseout

		32-Bit PCI			64-Bit PCI		
		PCI Rev. 2.2	PCI Rev. 2.3	PCI Rev. 3.0	PCI Rev. 2.2	PCI Rev. 2.3	PCI Rev. 3.0
Add-in Card	3.3 Volt						
	5 Volt						
	Universal						
Connector	3.3 Volt						
	5 Volt						

PCI Connector Configurations (full size)



What's Next in PCI

This discussion has covered PCI from only a few points of view: electrical signaling, bus width, and card/connector form factors. In addition we have only been discussing conventional PCI. The future of PCI contains leaps that will extend PCI's speed with evolutionary new specifications called PCI-X 2.0 and PCI-Express.

PCI-X 2.0

PCI-X 2.0 extends conventional PCI, yet remains backwards compatible. Existing PCI cards will fit the PCI-X 2.0 slot, and PCI-X 2.0 cards will fit conventional PCI slots. PCI-X 2.0 will implement 1.5 volt signaling to enable still faster clock speeds on the bus. Conventional PCI is a 33/66 MHz bus, while

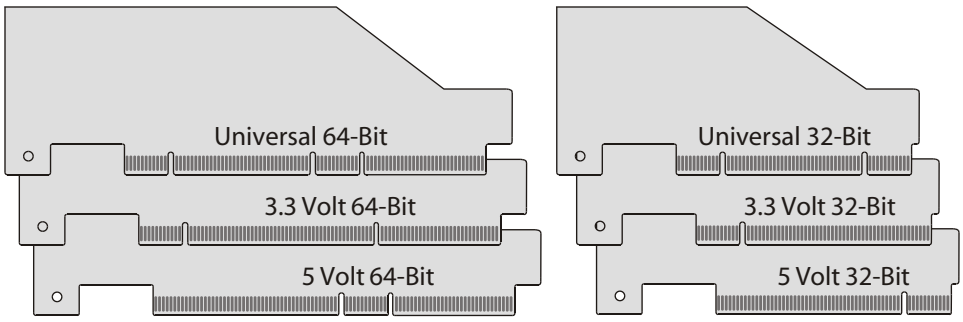
PCI-X 1.0b supports 66/100/133 MHz, and PCI-X 2.0 will support 66/100/133/266/533 MHz. This is 32 times the clock rate of the original PCI introduced 10 years ago!

PCI-Express

PCI-Express departs from the conventional PCI line somewhat by introducing its own connector and card designs. It will incorporate features designed to support demanding applications such as high-grade graphics, video editing, and streaming multi-media, and so will effectively support connections to technologies such as 1394b, USB 2.0, InfiniBand, and Gigabit Ethernet. It will be characterized by functionality such as Quality of Service handling, advanced power management, native hot-plugging, greater efficiency in bandwidth use per connector pin, and error detection and handling.

All this, just when you thought PCI was settling down!

PCI Add-in Card Configurations



PCI Card/Connector Compatibility Matrix

			Add-in Card					
			32-Bit			64-Bit		
			5 Volt	3.3 Volt	Universal	5 Volt	3.3 Volt	Universal
Connector	32-Bit	5 Volt	✔	✘	✔	32-bit operation	✘	32-bit operation
		3.3 Volt	✘	✔	✔	✘	32-bit operation	32-bit operation
	64-Bit	5 Volt	✔	✘	✔	✔	✘	✔
		3.3 Volt	✘	✔	✔	✘	✔	✔

COMDEX®

Fall 2002 Las Vegas

Lava was showing a number of new products at COMDEX Fall 2002 this year. Visitors to the Lava booth were interested to see Lava's new RS-422 products, the RS422 SS-PCI, RS422 DS-PCI, and RS422 Quattro-PCI. These 1, 2, and 4 port RS-422 boards are versions of Lava's popular RS-232 cards. These RS422 cards all have 16550 UARTs for throughputs up to 115.2 kbps.

Also on display were Lava's next product offerings: the Lava Ether-Serial device server family. These devices network-enable serial ports, making any serial device readily accessible across a TCP/IP connection. The Ether-Serial family have RS-232 serial ports in 1, 2, and 4 port versions.

Profile

First established in Ontario in 1990, Peripheral Express has become one of the top 10 distributors in Canada, with fully stocked warehouses and offices in major provinces. Starting with 3 persons, Peripheral Express now employs than 120 people nationwide. Sales have increased from $500,000 per annum in 1990 to $98 million in 1999, and Peripheral Express currently serves more than 7,000 customers monthly coast to coast.

Peripheral Express's offices in Toronto, Vancouver, Montreal, and Calgary each maintain a fully stocked warehouse to minimize downtime on orders. Their goal is to provide resellers with a stable 'one-stop' supply of high quality computer products, excellent service support, and very competitive prices. They continually improve their product and service offerings to ensure repeat customers.

Peripheral Express has close liaison with many well-known manufacturers, including Lava. In this way Peripheral Express can stay at the forefront of new computer product and technical information, which directly translates into benefits for their dealers. Peripheral Express's technicians are well-trained specialists who are capable of performing repair work at the board level. Support is available from all offices in Canada, and warranties are honored anywhere in the country. Customers who purchase in one province are given the same level of service in other provinces.

Peripheral Express

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