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LINK

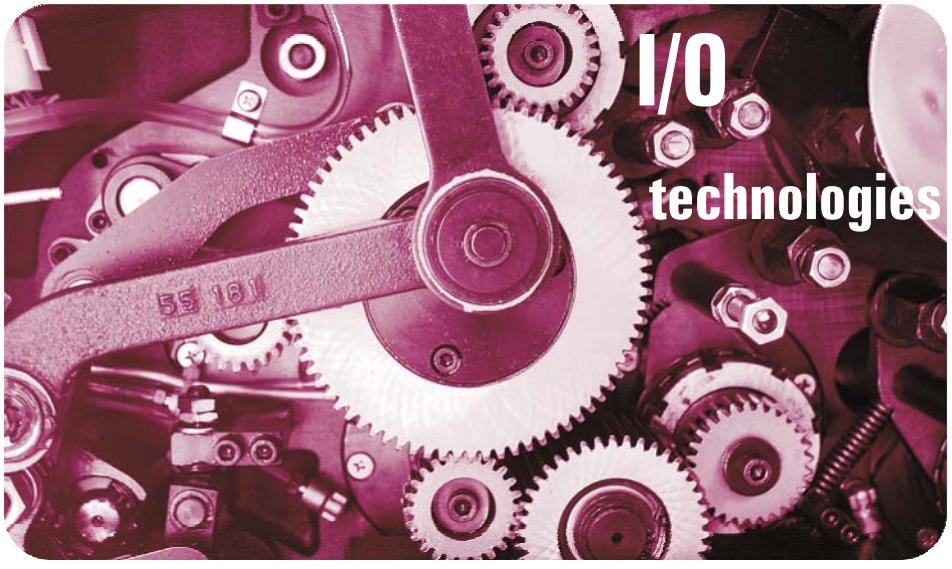
Lava I/O News

Inside this issue:

LAVA

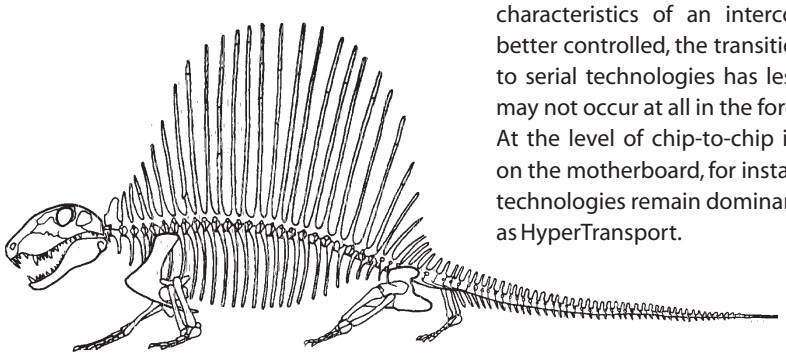
A Look at I/O Technologies

Technology & Desire



Like any new creation, a new I/O technology expresses, or maybe even fulfils, a desire. More even than our needs, it is our desires that drive technological innovation. The potential of a computer or network of computers to meet our desires is tied to the metrics of its I/O — how fast, how far, and how cheaply it can move data. This is true for any I/O technology, whether it connects chips, peripherals, memory, storage, processors, or networks. Desire makes us cast aside one I/O technology and embrace the promise of the next.

As a result, the history of I/O technologies is strewn with the carcases of abandoned or failed technologies — the extinctions of Microchannel, EISA, VL Bus, Token Ring, and others. Other I/O technologies have survived by shedding their earlier incarnations for newer ones: PCI, USB, SCSI, FireWire®, and Ethernet, to name a few. Like successful species of animals, they have evolved to meet demand. Yet others — RS-232 serial, for instance — approach immortality, in computer terms. Let's call that one the amoeba of the I/O technology world. Finally, still others — 10 Gigabit Ethernet, PCI-Express, IEEE 1394b, InfiniBand™, Serial ATA — point to the future fulfilment of desires that we have not, even yet, formulated. Their genetics in many cases are still being engineered.



So where is I/O going?

The evolutionary trend in I/O technologies, whether for bus-to-expansion card interconnection, or for cabled connection to external peripherals, has two general tendencies. Between technologies, there is an overall move from parallel to serial data transmission. Within any given technology, there is continually increasing speed. In some areas — particularly in external cabled connections to peripherals — these moves are well under way. The shift from parallel port interfaces to USB interfaces on typical consumer printers is a prime example. In other areas, where an interface has less need of physical distance and where the electrical characteristics of an interconnect can be better controlled, the transition from parallel to serial technologies has less impetus, and may not occur at all in the foreseeable future. At the level of chip-to-chip interconnection on the motherboard, for instance, parallel I/O technologies remain dominant in forms such as HyperTransport.

In the world of the mainstream PC, the move to serial technologies is perhaps most visible at present in the USB 1.1, USB 2.0, FireWire®, and Ethernet interfaces that are now commonplace. The next arena for change is in storage drive interface technology, as it moves from parallel interfaces (SCSI and IDE/ATA) to Serial ATA.

The server world, often a leading indicator of changes that will filter down to mainstream PCs, will continue to use the parallel bus technologies of PCI and PCI-X for some time to come, but servers are also early adopters of the newest serial technologies, including Gigabit and 10-Gigabit Ethernet, Fibre Channel, and Serial ATA.

While serial interconnection is not new, the serial technologies introduced in recent years have increased greatly in speed and sophistication. In many ways, new serial technologies like USB and IEEE 1394 (FireWire®) have built on well-established serial technologies like Ethernet. As a consequence, unlike the traditional RS-232 serial port that we all have seen for years, the newer serial technologies use packetized formats for sending their data. Another

InfiniBand™: Between a rock and a hard place

InfiniBand™, touted a couple of years ago as the next great thing in I/O technologies, seems to have been outflanked by the rapid evolution of a cluster of already-successful technologies. Never mind that you'd need new systems and peripherals from the ground up to take advantage of InfiniBand™, it is better technology, right?

As an advanced channel-based, serial switched, fabric I/O technology, InfiniBand™ is designed to provide a high-speed standardized interconnect for large servers. From there, it seemingly had the design versatility to adapt to a wide range of less-esoteric settings. The heavyweight founding members of the InfiniBand™ Trade Assocation — Compaq, Dell, Hewlett Packard, IBM, Intel, Microsoft, and Sun — are not exactly dabblers in the computer industry. The organization, started in 1999, merged two other I/O design groups, NGIO (Next Generation I/O) and FutureIO.

InfiniBand™ is an interesting creature. Intel's white paper, "The InfiniBand™ Architecture Imperative," describes it as "designed specifically to support a clean message-passing paradigm, multiple parallel channels, intelligent I/O controllers, high-speed switches, RAS (reliability, availability, serviceability)" and states that it would deliver "a point-to-point, scalable interconnect infrastructure, as well as flexibility and true wire-speed communications. In addition, its baked-in notions of link availability, fault isolation, multi-path I/O across redundant links, zoned/partitioned switches, and quality-of-service make it ideal for fast-changing and fast-growing configurations." *Whew.*

In actuality, InfiniBand™ was aiming to make a case that fundamental areas of I/O were not suited to the demands of the future. Included in the "weak areas" were PCI, Ethernet, Fibre Channel, and SCSI, particularly their overall interaction in servers and server pools. While this may be true, in the time since the InfiniBand™ Trade Association formed, all of those alternative technologies, and consequently the combination they represent, have jumped ahead. They are all now faster and more robust. Meanwhile, InfiniBand™ implementations are still rare. So the jury is out — let's call it "UnfinishedBand" for now.

PCI: Not going away any time soon

While journalists from time to time write of the demise of PCI, such commentaries can be found dating back more than five years. If it were the case that PCI was nothing more than the 32-bit motherboard slots we know and love, it might be the case that PCI's days were in fact numbered. ISA slots are an example of a bus technology nearing the end of a useful life in the mainstream.

As it turns out, the fact is that PCI remains strong in its own back yard — the PC motherboard — but has also successfully diversified. A variety of flavors of PCI move its usefulness into servers, embedded systems, and industrial systems, to name a few contexts. Compact PCI provides a physical interconnect for blade computers and other expansion devices in rack-mount systems; and for expansion cards, such as fiber and management boards in networking hardware such as switches. Mini-PCI makes PCI interfaces available to notebook systems, eliminating the need to have a docking station provide access to the PCI bus. The PCI Hot Plug specification makes the PCI interface adaptable to mission-critical systems that may need components swapped without shutting the system down. PCI card sizes that follow the low-profile PCI specification fit into the more compact chassis of newer systems. PCI slots feature in PC/104 and PCI-104 formats for embedded and industrial computers. PCI slots, whether conventional or PCI-X, have new 64-bit designs, low-voltage designs, and higher clock rates than ever. And PCI has made numerous technological improvements that keep it current.

The adaptability of PCI, and its demonstrated ability to move up the speed ladder while maintaining a high degree of backwards compatibility, are the reasons that some new technologies, such as InfiniBand™, have not gained a strong foothold. PCI does have inherent limitations that put it at a disadvantage in some contexts, but are you (yes, you) actually bothered that it is, for example, a shared bus technology? Probably not, or at least not for now.

Parallel-bus PCI-X will move eventually to serial-bus PCI-Express.

"network-like" development is the adoption of point-to-point switched architectures instead of shared bus topologies. Most of us don't think of the USB that we find on our PCs as a network, but in many ways it is.

Low-voltage designs have also yielded speed increases, both for parallel and for serial I/O technologies. Conventional PCI, and its next form, PCI-X, are both parallel bus technologies that are migrating to lower-voltage designs. Lower voltages, other things being equal, can manage a faster signaling rate than higher-voltage designs. Those same benefits will exist for PCI in the future, as it too becomes a serial bus with the advent of PCI-Express.

Virtually all successful I/O technologies evolve in speed: USB 1.1 to USB 2.0, IEEE 1394 to IEEE 1394b, PC-Card PCMCIA to CardBUS PCMCIA, SCSI and IDE/ATA through their seemingly endless variations, Ethernet to Fast Ethernet to Gigabit to 10 Gigabit Ethernet, and so on.

Sources and useful links:

Although by no means comprehensive, this list provides a good starting point for those who want to look more closely into I/O technologies.

- http://www.1394ta.org
  The IEEE 1394 Trade Association – industry news
- http://www.apple.com
  Apple Computers – a good additional source on FireWire®
- http://www.fibrechannel.org/
  The Fibre Channel Industry Association – news, members information and specifications
- http://www.hypertransport.org
  The HyperTransport Consortium – general information and specifications
- http://www.ieee.org, standards.ieee.org
  The Institute of Electrical and Electronic Engineers – industry news and specifications
- http://www.infinibandta.org/home
  The InfiniBand™ Trade Association – news and specifications
- http://www.intel.com/technology/agp/
  Intel's web page on the Accelerated Graphics Port (AGP) – information and specifications
- http://www.irda.org
  Infrared Data Association – information, specifications, and linking protocols
- http://www.pcisig.org
  The PCI Bus Special Interest Group – news and members' specifications
- http://www.pcmcia.org/
  The PCMCIA (Personal Computer Memory Card International Association) – information and specifications on PC Card, CardBus, SmartMedia Card, and the new ExpressCard
- http://www.rapidio.org
  The RapidIO Trade Organization – general information and specifications on this embedded system interconnect
- http://www.scsita.org/
  The STA (SCSI Trade Association) – specifications (for members)
- http://www.serialata.org/
  The Serial ATA Working Group – specifications for this new storage interface
- http://www.t13.org
  Technical Committee T13 AT Attachment – information on IDE, EIDE, ATA, ATA-2, ATAPI, Fast ATA, Ultra ATA, Ultra DMA, DMA/33, DMA/66, Serial ATA
- http://www.techfest.com/hardware/bus.htm
  TechFest BUS and I/O Standards page – a good summary and starting point for links to I/O standards
- http://www.usb.org/home
  The USB Implementers' Forum – the source for USB information and specifications

Profile

Bantam Electronics' new commitment and focus to their customers is to have a large-uncommitted inventory of wholesale parts and components available in Central Texas ready for immediate shipment to the industrial and commercial markets. To this end they have added many new lines and have added a dedicated inside and outside sales force to serve the needs of the market.

Bantam will continue to have their wholesale value center available for those who prefer to browse. Also included will be their new computer tech area where they build systems for small and large businesses and education facilities. Also, Bantam will continue to carry a large inventory of components. Their dedication to their customers, built over 30 years of experience in the Central Texas area, continues.

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ETHER-SERIAL LINK PRODUCT SUMMARY

	Ports			Connectors			Modes			
Product	**1**	**2**	**4**	**DB-9**	**RJ-45**	**Powered**	**RS-232**	**RS-422**	**RS-485**	**TTL**
Ether-Serial Link 1-DB9	✔			✔			✔			
Ether-Serial Link 2-DB9		✔		✔			✔			
Ether-Serial Link 4-DB9			✔	✔			✔			
Ether-Serial Link 1-RJ45	✔				✔	✔	✔			
Ether-Serial Link 2-RJ45		✔			✔	✔	✔			
Ether-Serial Link 4-RJ45			✔		✔	✔	✔			
Ether-Serial Link 1-DB9/P	✔			✔		✔	✔			
Ether-Serial Link 2-DB9/P		✔		✔		✔	✔			
Ether-Serial Link 4-DB9/P			✔	✔		✔	✔			
Ether-Serial Link 1-DB9/422	✔			✔				✔		
Ether-Serial Link 2-DB9/422		✔		✔				✔		
Ether-Serial Link 4-DB9/422			✔	✔				✔		
Ether-Serial Link 1-RJ45/422	✔				✔	✔		✔		
Ether-Serial Link 2-RJ45/422		✔			✔	✔		✔		
Ether-Serial Link 4-RJ45/422			✔		✔	✔		✔		
Ether-Serial Link 1-DB9/485	✔			✔					✔	
Ether-Serial Link 2-DB9/485		✔		✔					✔	
Ether-Serial Link 4-DB9/485			✔	✔					✔	
Ether-Serial Link 1-RJ45/485	✔				✔	✔			✔	
Ether-Serial Link 2-RJ45/485		✔			✔	✔			✔	
Ether-Serial Link 4-RJ45/485			✔		✔	✔			✔	
Ether-Serial Link 1-TTL	✔									✔

OTHER LAVA PRODUCTS

Serial Boards

PCI	SSerial-PCI	Single 9-pin serial, 16550 UART
	SSerial-PCI/LP	Single 25-pin serial, 16550 UART, low profile
	SSerial-PCI 3.3V	Single 9-pin serial, 16550 UART, for 3.3 volt PCI
	RS422 SS-PCI	Single 9-pin serial, 16550 UART, RS-422 pinouts
	DSerial-PCI	Dual 9-pin serial, 16550 UARTs
	DSerial-PCI/LP	Dual 9-pin serial, 16550 UARTs, low profile
	DSerial-PCI 3.3V	Dual 9-pin serial, 16550 UARTs, for 3.3 volt PCI
	RS422 DS-PCI	Dual 9-pin serial, 16550 UARTs, RS-422 pinouts
	Quattro-PCI	Four-port 9-pin serial, 16550 UARTs
	Quattro-PCI 3.3V	Four-port 9-pin serial, 16550 UARTs, for 3.3 volt PCI
	RS422 Quattro-PCI	Four-port 9-pin serial, 16550 UARTs, RS-422 pinouts
	Octopus-550	Eight-port 9-pin serial, 16550 UARTs
	LavaPort-650	Single 9-pin serial, 16650 UART
	LavaPort-PCI	Dual 9-pin serial, 16650 UARTs
	LavaPort-Quad	Four-port 9-pin serial, 16650 UARTs
ISA	SSerial-550	Single 25-pin serial, Com 1-4, 16550 UART, IRQ 3/4/5/7
	DSerial-550	Dual 9-pin serial, Com 1-4, 16550 UARTs, IRQ 2/3/4/5/7/10/11/12/15
	RS422-550	Dual 9-pin serial, 16550 UARTs, RS-422 pinout
	LavaPort-ISA	Single 9-pin serial, Com 1-4, 16650 UART, IRQ 2/3/4/5/10/11/12/15
	LavaPort-PnP	Single 9-pin serial, 16650 UART, Plug and Play

Parallel Boards

PCI	Parallel-PCI	Single EPP parallel
	Parallel-PCI/LP	Single EPP parallel, low profile
	Parallel-PCI 3.3V	Single EPP parallel, for 3.3 volt PCI
	Dual Parallel-PCI	Dual EPP parallel
ISA	Parallel Bi-directional	Single bi-directional parallel port, LPT 1/2/3, IRQ 5/7
	Parallel-ECP/EPP	Single ECP/EPP parallel, LPT 1-6, IRQ 2/3/4/5/7/10/11/12

Combo Boards

PCI	SP-PCI	Single 9-pin serial, 16550 UART + single bi-directional parallel
	2SP-PCI	Dual serial (9 & 25-pin), 16550 UARTs + single EPP parallel
	LavaPort-Plus	Dual serial (9 & 25 pin), 16650 UARTs + single EPP parallel
ISA	2SP-550	Dual 9-pin serial, Com 1-4, 16550 UARTs + single bi-dir.parallel, LPT 1-2

USB 2.0 & 1.1 Devices

	USB 2.0 Host Adapter	Dual USB 2.0 ports, 480 Mbps, fits in PCI slot
	USB 1.1 Host Adapter	Dual USB 1.1 ports, 12 Mbps, fits in PCI slot
	SPH-USB 1.1 Hub	Three powered USB 1.1 ports, parallel port, serial port, connects to USB

IEEE 1394 (FireWire®) Devices

	IEEE 1394 FireHost	Dual IEEE 1394 ports, 400 Mbps, fits in PCI slot
	IEEE 1394/IDE Controller	FireWire®-to-IDE hard drive interface

Specialty Boards

PCI	8255-PIO	8255 PIO interface card

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