



# FPGAs for Serial Interconnections

Research by Electronic Trend Publications points to a key role for FPGAs in serial interconnections.



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For most of the last 15 years, networking the world for voice, video, and data has been the key driver of the electronics industry. This worldwide network required that the communications industry connect and converge with the computer processing industry. That convergence has primarily settled on Ethernet for the communications side and PCI for the computer side.

Since its inception, Ethernet has been a serial interface. It has been repeatedly scaled up in bandwidth. Today, 1 Gbps connections are ubiquitous, 10 Gbps connections are becoming more common, and 100 Gbps connections have been proven in the laboratory. Ethernet has vanquished all challengers in the LAN market and is rapidly conquering the MAN and WAN markets.

PCI started out as a parallel interface, and as such ran out of bandwidth when connection requirements exceeded 1 Gbps. Industry groups such as the InfiniBand Trade Association and the RapidIO Trade Association introduced new connections to replace PCI. But PCI is much more than the physical connection between system elements. PCI represents an enormous global investment in software that is not readily replaceable. Only PCI Express has met the challenge of true compatibility with PCI. PCI Express bandwidth will be scaled up repeatedly over the coming years to support the industry's needs.

As a result of the nearly 10-year effort to transition the industry from parallel to serial interconnections, serial interconnections

will soon become dominant. Table 1 illustrates the change from parallel to serial. In 2006, serial interconnections will move into the majority. By 2009, serial will represent more than 80 percent of all interconnections.

Although standard semiconductor products will supply the serial interconnection needs of high-volume markets, FPGAs are increasingly important for a wide variety of tasks. There are some key reasons. First, before low-cost standards products are available, FPGAs will provide a mechanism to get to market faster. Second, FPGAs enable system integration with customer algorithms and standards-based serial interfaces. Third, the ability to easily make multi-standard serial connections to FPGAs will dramatically simplify product design.

Thus, the new Xilinx® Virtex™-5 LXT platform – with its built-in PCI Express Endpoint blocks, tri-mode Ethernet MACs, and low-power RocketIO™ transceivers – precisely fits the requirements of today's FPGA market by giving designers a solution that not only saves time, but also reduces power consumption and conserves FPGA logic resources.

## RapidIO and Aurora

Although PCI Express and Ethernet will be the overwhelming leaders in the number of serial ports deployed by the industry, a host of other serial interfaces have carved niches for themselves. The Virtex-5 LXT platform

also supports nearly all available serial interfaces. Two of these interfaces – RapidIO and Aurora – are emerging as most important to users of FPGAs.

RapidIO is becoming a favorite for high-end, low-volume DSP applications. A number of implementations in this arena use FPGAs (rather than merchant silicon) to implement DSP functions as well as RapidIO interface and switching functions. This should continue to be the case in the future.

Similarly, the Aurora protocol has quietly gained a substantial following in certain high-end embedded markets. Although Xilinx created Aurora, it is an open protocol, free of charge, that designers can implement in any silicon device. Aurora is a scalable, lightweight, link-layer protocol that is used to move data across point-to-point serial links. Aurora enables simple, high-speed connections between fixed points either on a single board or across multiple boards. As many applications in the board-level embedded market use fixed links between various points in the system, there is no need for a complex message-passing protocol.

## Conclusion

With its hard-coded PCI Express Endpoint and Ethernet blocks, I anticipate that many will use the Virtex-5 LXT platform to bridge between PCI Express or Ethernet and numerous other interfaces. The Virtex-5 LXT platform is ideally suited for this task. ●●

Serial vs. Parallel Ports	2004	2005	2006	2007	2008	2009
Parallel	75.5%	56.3%	34.8%	25.5%	20.4%	15.9%
Serial	24.5%	43.7%	65.2%	74.5%	79.6%	84.1%

Figure 1 – Serial interfaces are rapidly replacing parallel.