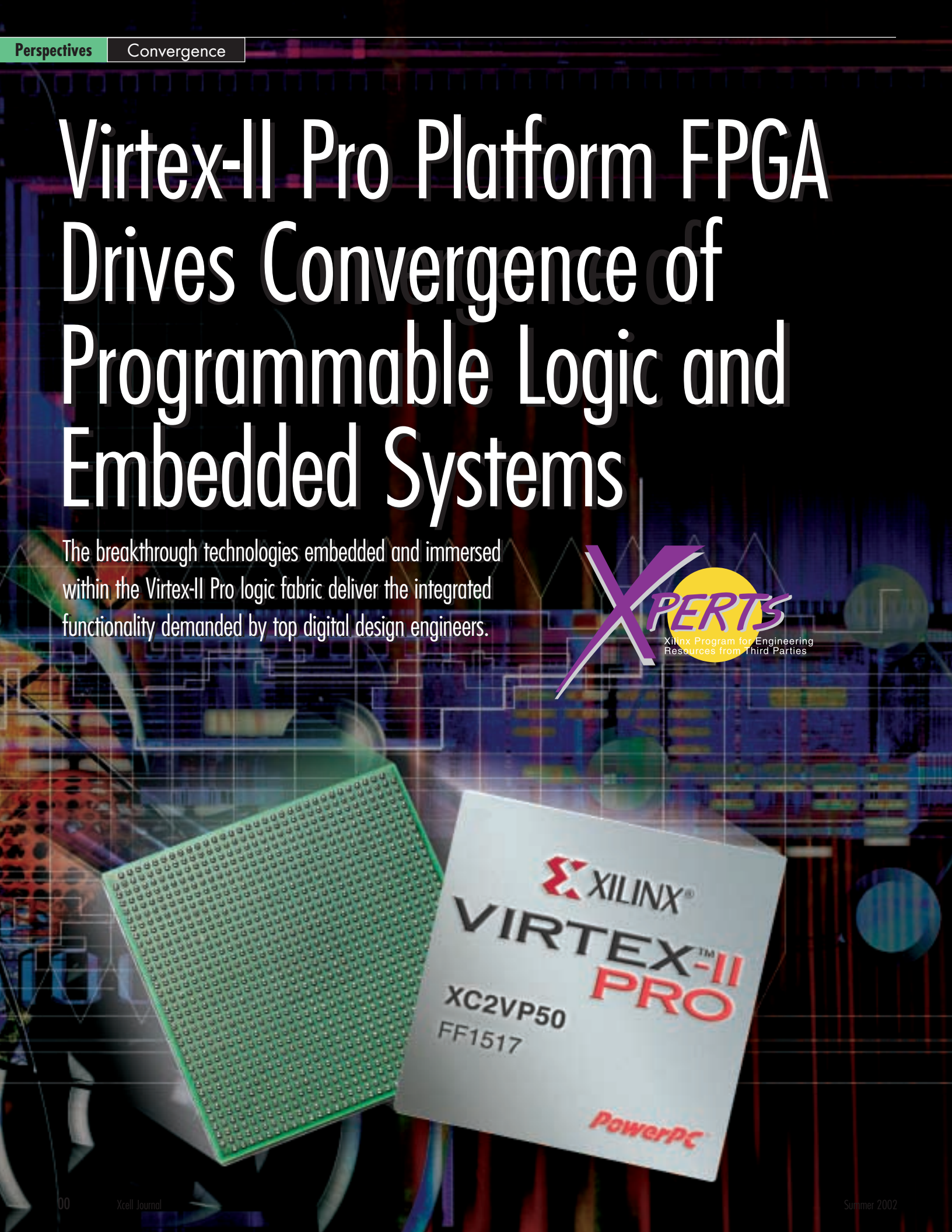
Virtex-II Pro Platform FPGA Drives Convergence of Programmable Logic and Embedded Systems

The breakthrough technologies embedded and immersed within the Virtex-II Pro logic fabric deliver the integrated functionality demanded by top digital design engineers.

XPERTS
Xilinx Program for Engineering Resources from Third Parties



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Time to market pressures have ruled out designing an ASIC from scratch, but without a custom ASIC, the discrete FPGA, microprocessor, and off-board high-speed serial I/Os will never fit last year's form factor. You just can't fit 16 channels this year on a board designed for four channels last year.

As a Xilinx XPERTS partner and an engineering services company working in the cross disciplines of FPGAs, printed circuit boards, and firmware, we at Nuvation Engineering often encounter these problems of form, fit, and function. We need an onboard industry standard microprocessor, integrated high speed I/Os, off-the-shelf IP blocks, and double last year's gate count.

Xilinx has delivered on all this and more with their introduction of the revolutionary Virtex-II Pro™ Platform FPGA. It starts with the technologically advanced Virtex™-II infrastructure, supporting up to 8 million gates and I/O serial speeds of 3.125 Gbps. Nestled into this digital workshop is the IBM PowerPC™ 405 microprocessor – the number one embedded CPU for networking and telecom infrastructure. The continued convergence of programmable logic with embedded systems has created a new digital workbench with a wealth of integrated platform standards and rapid co-development tools. The Virtex-II Pro Platform FPGA is in a class by itself in the exploding programmable embedded market.

FPGAs and Microprocessors: A Symbiotic Relationship

Fundamentally, microprocessors and FPGAs fulfill different tasks (see Table 1). Programmable logic is needed for wire speed, high bandwidth, custom digital processing, and hardware acceleration. However, that speed and customization comes at a price, both in parts and non-recurring engineering (NRE) costs.

For monitoring and control tasks, it is far cheaper and easier to use a microprocessor. Furthermore, microprocessors have existed longer and have a larger base of engineering familiarity. Thus, many product architectures naturally marry an FPGA with a microprocessor. At Nuvation, our complex designs often start with an FPGA and microprocessor architecture, then we determine which system functions are best implemented in each. Xilinx takes this to the next level by integrating these functions into a single chip.

FPGA	Microprocessor
• Configurable and programmable digital logic	• Fixed processing units accessed by predefined commands
• Instantiate multiple processing units to run tasks in parallel	• Greater knowledge, tools, installation base and engineering familiarity
• Hardware accelerate high speed tasks	• Faster development time
• Scalable	• Lower parts costs
• Coded in HDL	• Coded in firmware such as C

Table 1 - Functional comparison of microprocessors and FPGAs

A more traditional design would be a microprocessor integrated with dedicated hardwired logic in an ASIC. However, time to market pressures are demanding platforms with full product cycles in months and integration cycles in hours. Compared to the time for ASIC development and potential respins, FPGAs present a highly appealing alternative.

Because the FPGA is reprogrammable after release, using technologies such as the Blue Iguana™ System, a whole new market of revenue streams and business models is opened. Xilinx has risen to these market pressures by systematically driving down the cost of customized hardware acceleration while producing continued innovation in size, speed, and integrated features.

Virtex-II Pro Features

The Virtex-II Pro Platform FPGA brings together market-leading Xilinx programmable logic with the industry standard PowerPC (PPC) microprocessors and high-speed I/Os. Truly this is the digital sandbox for the 21st century engineer.

Integrate Off-the-Shelf IP

The Virtex-II Pro device offers as many as 8 million system gates. This allows easy and rapid SoC (system-on-chip) integration of existing IP cores without having to painstakingly code a custom implementation of a standard interface to save a few gates.

The Virtex-II Pro FPGA allows you to choose up to four PPC built-in cores. No longer do you have to meticulously calculate how many clock cycles each firmware operation will take to determine the processor infrastructure. If the first PPC becomes overloaded, just change the part number and add another PPC to the Virtex-II Pro FPGA. You don't have to respin the board or, worse yet, you don't have to deal with an increase in the form factor rippling to mechanical changes.

The off-the-shelf features of Virtex-II Pro devices are matched with on-chip memory of up to 4.5 MB. With this onboard memory, you can get high-speed, on-chip bus connects without being bottlenecked by a memory arbiter to off-chip memory.

Flexible Clocking Infrastructure

Any first year student learns the first rule of digital synchronous logic: never gate the clock. Well, Xilinx has packed that up with the vacuum tubes and created an architecture that allows you to switch – glitch-free – among as many as 16 global clocks. This is a huge benefit for sharing system resources among different clock domains. The Xilinx Digital Clock Manager also provides on-chip frequency and phase control, meaning that an off-chip, phase-locked loop is no longer needed.

XCITE On-Chip Impedance Control

After drawing a thousand-pin FPGA, the last thing a design engineer wants to deal with is adding a few hundred termination resistors. Xilinx Controlled Impedance TEchnology (XCITE) eliminates those resistors with dynamic, on-chip, digitally controlled impedance. The savings in board space, schematic time, and layout time are significant.

Integrated High Speed I/O

It seemed not too long ago that it was cutting-edge to support 64-bit, 66 MHz PCIs. Now we are up to PCI-X speeds at 133 MHz. We have support for RapidIO™, POS-PHY4 and SPI-4 interconnect technologies, to name a few. Pick almost any kind of memory you like – ZBT™ SRAM, DDR SDRAM, or QDR SDRAM, for instance – and they can be implemented in the Virtex-II Pro logic fabric. Then we jump into serial I/O space, and the Virtex-II Pro platform can accommodate as many as 16 Rocket I/O™ multi-gigabit transceivers at a whopping 3.125 Gbps. This means applications like OC-48 can integrate SERDES (serializer/deserializers) right into the FPGA – once again, saving board space, cost, and valuable time.

Integrating Customer Hard IP

Hard IP is when digital logic is implemented in hard coded gates, removing the programming capability, but also using much less silicon. Once a design or IP block is stable, it can be converted to hard IP. The PPC 405 microprocessor is currently implemented in the Virtex-II Pro device as hard IP, but Xilinx actually allows customers of sufficient volume to embed their own hard IP. For example, if you wanted to roll out an existing ASIC to provide additional capacity and integrate the microprocessor, the Virtex-II Pro could embed that ASIC as hard IP and provide programmable gates for new functionality.

Integrated Bitstream Security

The Virtex-II Pro device has on-chip storage capacity for a 3DES key, either with a battery or constant power supply. The stored or delivered bitstream is encrypted, and can only be unlocked with the on-chip key. The on-chip key allows Virtex-II Pro devices to be designed into military applications that traditionally have required OTP (one time programmable) solutions to remove any chance of code becoming compromised.

Reconfigurability

The Virtex-II Pro Platform FPGA can be made even more powerful by enabling remote configuration capabilities. Xilinx IRL™ (Internet reconfigurable logic) technology includes a partnership with Wind River Systems Inc. to produce the PAVE Framework – PLD API for VxWorks™ Embedded System Integration Framework. The framework enables Xilinx FPGAs using Wind River's VxWorks real-time operating systems and Tornado™ integrated development environments to be reconfigured during development and after deployment in the field.

Additionally, Xilinx is in partnership with Blue Iguana Networks Inc., a semiconductor company that provides secure, remote, hardware management. Their patented technology enables secure software and hardware upgrades to in-service equipment over the Internet and without downtime. The Virtex-II Pro Platform FPGA is an excellent match for Blue Iguana's technology, as the embedded microprocessor could upgrade the FPGA, or vice versa.

Conclusion

Because microprocessor and FPGA functionalities differ, as applications become more complex and diverse, it is often insufficient to utilize just one or the other. The development of the Xilinx Virtex-II Pro Platform FPGA resulted from the natural integration of FPGAs and microprocessors. In the past, the only solution would have been to utilize multiple, discrete ASICs. However, because of the time to market requirements – in addition to the potential expenses associated with an error – reconfigurable processing has become an ideal alternative.

With digital design engineers facing the pressures of increased flexibility, shorter time to market, and higher clock speeds, they will continue to drive the demand for integrated standard platforms. The Virtex-II Pro Platform FPGA does a masterful job of combining a highly technologically advanced FPGA architecture with the industry standard IBM PowerPC microprocessor. As a member of the Xilinx Early Adopters Program, as well as a Xilinx XPERTS partner, we at Nuvation look forward to implementing this breakthrough technology for the benefits of our clients. For more information, please visit us at *www.nuvation.com.*