

Challenges and Opportunities for FPGA Programmable System Platforms

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Process technology and architecture innovation are the two engines that have fueled a spectacular advancement in FPGAs over the past 10 years. During this period, the price of FPGAs has been reduced with 2 orders of magnitude, the logic capacity of FPGAs has been increased with 2 orders of magnitude and the performance has been increased with one order of magnitude. Whereas ASICs buck the tide of processing technology, FPGAs ride the tide. Deep submicron effects are breaking the traditional modular design flow of traditional SOC architectures. A growing portion of the design time is spent on dealing with deep submicron effects, at the expense of the creative process of design authoring. Surveys show that, today, less than 20% of the design time, for complex SOCs, is spent on design authoring.

Programmable FPGA platforms give designers the benefits of deep submicron but rather than focusing on getting the silicon to work, you can focus on getting the design to work. Today, several million logic gates can be implemented in FPGAs, as such covering the sweet spot of the ASIC market. By combining the programmable nature of the FPGA with advanced testing methodologies, the fitness of a specific piece of silicon can be guaranteed for a given application. The increased yield associated with the custom testing approach allows to further reduce price of large FPGAs with more than 80%. As a consequence, FPGAs are being used for ever higher product volumes. FPGAs, through their regular, parallel architecture and distributed memory organization can continue to take benefit of scaling dimensions by adding more parallel hardware and distributed memory. Von Neumann architectures, originating from the days when silicon area was very limited, have been dictating sequential programming models. Spatial computing, exploiting massive resources of parallel hardware will change the way we program future system platforms. We predict that FPGAs will become the heart of most systems over the next 5 years, replacing ASICs and processors as the fabric of choice.