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Predictable Success

Synopsys and Cray

FPGA-Based Prototyping System Enables Robust Testing and Early Software Development for Network Interface ASIC Design

Synopsys' automated FPGA-based prototyping system helped us start OS development 6 months earlier, avoid respins, and speed time-to-market. "

Thomas F. Rossman
Sr. Manager, Engineering, Cray Inc.

Business

A global leader in supercomputing, Cray Inc. provides innovative computing platforms that enable scientists and engineers in academia, government, and industry to meet both existing and future computational challenges on a wide variety of applications.

Challenges

- Needed easy-to-use FPGA-based prototyping system not requiring expert FPGA design experience
- Needed fast turnaround time
- Needed a more robust testing infrastructure
- Wanted to enable earlier SW development
- Required debugging visibility on live, running hardware

Synopsys Solution

- Synopsys' Automated FPGA-based Prototyping System with Universal Multi-Resource Bus

Benefits

- Automated partitioning and synthesis flow made it easier for the ASIC design team to prototype
- Enabled earlier OS development by 6 months
- Estimated time-to-market 3 months faster with higher confidence in tapeout

Overview

As part of Cray's next generation technology for supercomputers, the ASIC design team needed to create a network interface chip with more than 50M gates incorporating IP from three different vendors.

The ASIC uses the Joint Test Action Group (JTAG) bus as the primary interface for the more than 100,000 processors in the system. Tasks include: system initialization, system configuration, system reset, RAM initialization, and diagnostic testing and monitoring.

The team wanted a high-speed FPGA-based prototyping system for this large ASIC design in order to enable more robust testing and earlier software development. Since they were not expert FPGA designers, they needed a system with an easy-to-use tool flow for FPGA synthesis, partitioning, and debug.

Not all ASIC teams have FPGA expertise on-hand for prototyping. Using the Synopsys FPGA-based prototyping system meant we could focus on design optimization instead of FPGA specific tasks."

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Sr. Manager, Engineering, Cray Inc.

Leading FPGA-Based Prototyping Solution

Synopsys' Automated FPGA-based Prototyping System is based on patented 3D Switching Technology offering the highest interconnect flexibility between FPGAs and expansion slots, and enables an optimized implementation to achieve the highest possible system performance. These systems are based on the latest Xilinx Virtex-5 FPGAs and can handle complex ASIC and SoC designs up to 50M ASIC gates.

Synopsys provided a comprehensive set of tools for fast and automated design implementation, powerful debugging and extensive design and software verification. Cray took advantage of the Universal Multi-Resource Bus (UMRBus) as the communication channel between the FPGA-based prototype hardware and the client application (CAPP) to run extensive software development and test. The Cray team connected the UMRBus through a scalable number of client application interface modules (CAPIMs), which were based on an IP core provided by Synopsys. Leveraging the UMRBus command routines, HW/SW integration was greatly eased and Cray was able to get pieces of the software up and running against the prototype in only a week.

Synopsys' integrated debugging tools provide designers with high visibility into complex designs enabling them to find bugs more quickly and easily.

Cray chose the Synopsys solution in part because it offered the most complete debugging tools compared to other options at the time. In this case the debugger not only caught many expected errors, but also found many unexpected errors (e.g., SW initialization) which would not normally have been found until the ASIC prototype came back from manufacturing.

Cray was impressed with the system's capacity and speed allowing them to run targeted diagnostic suites. For example, they were able to run a Test TCP with 30Mb of data in only 30 seconds. Due to the systems optimized flow and speed, the team estimates an earlier time-to-market by 3 months.

With the prototype, the hardware team was also able to give the software team earlier access for OS development by 6 months. The software team, at first skeptical about the capabilities and use of the Synopsys prototyping system, now regard it as a key tool in their department.

Cray is now on their way to delivering next generation computing platforms and plans to continue using Synopsys' FPGA-based Prototyping Systems.

Synopsys' debug capabilities caught both expected and unexpected bugs saving us from manufacturing the ASIC prototype only to find critical software errors too late."

Thomas F. Rossman
Sr. Manager, Engineering, Cray Inc.

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