

Synopsys and Infineon Technologies AG

Infineon is Fast to Market with Multiple-Media SoC for Small Office/Home Office Systems

Infineon Technologies AG, formerly Siemens Semiconductor Group, is among the top 10 revenue-earning semiconductor manufacturers in the world. The company focuses on products and systems for telecommunications, automotive engineering, high-frequency applications, memory chips, and chip card ICs.

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Systems

Issues

- Get an advanced communications SoC to market quickly, to meet immediate market demand
- Create an intricate simulation model
- Verify a complex design

Solution

- A project-specific Pre-Silicon Conformance Lab
 - Synopsys Eagleⁱ® for co-verification of hardware and software
 - Synopsys Cyclone® for high performance cycle-based simulation
 - Synopsys Telecommunications ATM Workbench++ for early and rapid standards conformance verification
 - Synopsys Professional Services design assistance services

Benefits

- Accurate processor model for hardware/software co-verification, resulting in faster time to market
- Threefold speed-up in simulation runtime
- High-performance verification of telecommunications standards
- Custom extensions to the ATM Workbench++ for chip-unique interfaces
- C models of the chip to support design-in by Infineon customers

For Infineon Technologies AG, the future is already here. Futuristic products like Infineon's Harrier XT IC can't get to market fast enough. Infineon needed to develop a system on chip for the small office/home office (SO/HO) market to carry voice, video and data traffic over the same copper lines that currently carry telephone communications. Demand for such a chip was high. Customers already

had target applications in trial using discrete components, and they were ready for integrated solutions. So Infineon needed Harrier XT right away.

The Harrier XT is a complex system on chip (SoC) that integrates everything necessary to convert multiple data streams to and from ATM cells, including multiple interfaces and an embedded microprocessor. The Harrier XT development effort,

performed in Dusseldorf, Germany, presented Infineon with one over-riding challenge—schedule. Franz-Josef Schaefer, ATM IC team design manager for Infineon Technologies AG, underscores the need to move quickly: "Between tape-out of the prototype processor and final IC tape-out, we had only one and a half months. That's not much headroom."

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Tailoring a Pre-Silicon Conformance Solution

To accelerate time to market, Infineon needed a powerful, high-performance environment for early verification of standards conformance. With the complexity of the SoC and the intensity of the schedule pressure, waiting until silicon production for laboratory testing was too risky. It would take too long to fix conformance failures detected at that late date. The solution proved to be a Pre-Silicon Conformance Lab, (PSCL) with design and verification tools, methodologies, and flows tailored specifically to the

Harrier project with the assistance of Synopsys Professional Services design assistance services.

A Pre-Silicon Conformance Lab is a Synopsys approach to fully verifying conformance before the hardware stage, reducing verification cycles and conformance risk. The PSCL derives test requirements and test suites from the system specification and provides a seamless verification flow for running the test suites at appropriate design steps from specification to prototype.

The Harrier project team utilized Synopsys Professional Services design assistance services to help integrate a customized PSCL solution that included several Synopsys tools: Synopsys Eagle*i* for co-verification of hardware and software, Cyclone for cycle-based simulation and the Telecommunications ATM Workbench++.

"The three pieces [of the PSCL]—the ATM Workbench++, Cyclone and Synopsys Eagle*i*—were the main reasons to choose Synopsys," says Schaefer.

Coping with the Complexities of Co-Verification

This was the first time Infineon had attempted to co-verify an embedded processor within its environment on a chip. The traditional method of verifying such processors is to build and test a prototype. With customers ready to put the chip into beta implementations immediately, that method would take too long. Performance of both the chip and the processor would have to be verified—simultaneously—by modeling.

Verifying the chip and its embedded processor simultaneously presented a significant challenge. Infineon turned to Synopsys and the Synopsys Eagle*i* tool set. “We chose Synopsys Eagle*i* for co-verification of the interaction of the hardware and software,” says Schaefer. Synopsys Eagle*i* tools enable developers to extend hardware design and development methodologies to support concurrent verification of both parts of the design, long before prototype availability.

Errors or misinterpretations of system specifications are revealed early in the post-partitioning stage of the design. The open architecture of Synopsys Eagle*i* tools supports high-performance electronic design automation (EDA) tools, including cycle-based simulators, hardware accelerators and hardware emulators. The tools also come in a wide range of model types, so that developers can match the tool to the design task.

Infineon had favorable experience with Synopsys Eagle*i* tools from previous development efforts, so the decision to employ the tools was an easy one. However, co-verifying an embedded processor for the first time posed new complexities and the Harrier team had to gain experience fast. Synopsys Professional Services provided immediate expertise and a rapid start for the Infineon team toward becoming power users of the co-verification tools and methodologies.

on-chip

Modeling a Complex Reality

The Harrier project demanded an intricate simulation environment that modeled the processor itself, which was still in development and also simulated the software environment in which the chip would ultimately run. The latter required “virtual peripherals,” that mimicked the appropriate data streams, and realistic scenarios to test the design’s behavior.

“Synopsys developed the processor model so that we could verify the operating system on the chip at a time when the processor wasn’t available,” says Schaefer. “The model actually suited our needs better than the real processor because it simulates faster. Using the model probably saved us three months.”

Experience and methodology were crucial to this core assignment. The simulation had to be accurate enough to adequately test issues that might arise when real data streams were fed in from third-party peripherals. Infineon found that Synopsys Professional Services’ experienced consultants added much value. “Synopsys offers a comprehensive and integrated methodology that spans from the system-level down to the bit-level,” says Schaefer. “And perhaps the most valuable thing about Synopsys is the depth of resources and expertise in the organization.” This expertise, gained on projects for other clients acted as a reality check, ensuring that the test results were authentic and substantially accelerating the development effort.



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The Speed of Cycle-Based Simulation

The Harrier project is a conspicuous example of the two-horned dilemma that is making conventional simulation techniques obsolete—larger designs and narrower market windows. Infineon confronted this dilemma with the Synopsys Cyclone VHDL cycle-based simulator.

Cyclone VHDL increases performance and capacity by working directly at the Register-Transfer-Level (RTL). Built to handle large designs, extensive test benches and large memories, Cyclone VHDL accepts a broad range of RTL constructs. It simulates the design, test benches and memories in the cycle-based engine to take maximum advantage of the higher performance of cycle-based simulation.

“Cycle-based simulation would allow us to start software development earlier,” points out Schaefer. “We knew from previous experience that Synopsys Eagle*i* and Cyclone have been used together successfully. Using cycle-based simulation, we were able to accelerate simulation by a factor of three.” In this area, too, Synopsys Professional Services helped the Harrier team quickly get up-to-speed at using the new methodology to optimum advantage.

Accelerating Standards Verification

The Harrier team needed a more powerful verification environment for the telecommunications standards—one that provided high throughput and high confidence in compliance. The solution was the Synopsys ATM Workbench++, which is written in C and can be run directly from a workstation instead of on the simulator. Synopsys Professional Services consultants wrote extensions

to the ATM Workbench++ customized specifically for the Harrier XT interfaces.

In the course of the project, Infineon found many ways to leverage Synopsys' skills. Synopsys Professional Services consultants reviewed existing Harrier code, to make sure it would be compliant with the new technologies the project would employ.

Infineon also took advantage of Synopsys Professional Services C programming talent. Infineon supplies a design-in model with the Harrier XT, so that its customers can incorporate the chip into larger boards or systems. Short on time and resources, Schaefer enlisted Synopsys Professional Services consultants to rewrite parts of the model in C code.

Conclusion

The Infineon Technologies AG, Harrier XT IC project can claim many successes that add up to faster time to market: An accurate processor model for hardware/software co-verification. A threefold speed-up in simulation runtime. High-performance verification of compliance to telecommunications standards. And effective Pre-Silicon Conformance Lab methodologies that will carry over to future projects.

What impressed Schaefer most about working with Synopsys? "I think the most valuable thing about Synopsys Professional Services is the organization behind them," he says. "We had local access through their headquarters in Germany, and the availability of their knowledgeable consultants was really very good. And the collaboration among the different groups in Synopsys was good as well."

For more information on Synopsys Professional Services call your local Synopsys sales representative, or visit us on the Web at www.synopsys.com/psg

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