

SOKRATel ADVANCES DETERMINISTIC CONTROL WITH AMD ZYNQ™ ULTRASCALE+™ MPSOC CASE STUDY

Using SIRIUS OS and model-based design, Sokratel enables multi-rate, real-time control for renewable energy and industrial systems.



EXECUTIVE SUMMARY

As global industries accelerate the transition to electrification, automation and renewable energy, demand is rising for predictable, high-performance, real-time control systems that support reliable and affordable power. These systems must coordinate multiple time-critical workloads while maintaining precise synchronization, particularly in large-scale industrial and energy applications.

Sokratel, a German-based company that specializes in automotive and industrial automation systems, worked with AMD to address these requirements with Sokratel SIRIUS OS, a real-time embedded software platform powered by AMD Zynq™ UltraScale+™ MPSoC devices. SIRIUS OS enables engineers to deploy complex, multi-rate control applications on a single device by combining programmable logic and multicore processing with a model-based design workflow tightly integrated into MATLAB® Simulink®.

The solution is designed to reduce development time, simplify system design and deliver the performance required for demanding applications such as wind turbine control.

INTRODUCTION

Sokratel provides engineering services and software platforms for embedded systems, industrial communication, and automation across a range of industries.

“We serve two main industries: automotive and industrial automation,” said Malte Jongmanns, embedded software engineer at Sokratel. “We have multiple competencies in automation, offering everything from IoT to proof-of-concept development to putting software onto devices. We also do a lot of consulting, especially in the energy sector with wind turbines.”

A core differentiator for Sokratel is its ability to bridge high-level, model-based control designs with low-level embedded implementation, allowing control engineers to move from simulation to deployed hardware more efficiently.

INDUSTRY

Industrial

AT A GLANCE

1. AMD MPSoC enables real-time system control on a single device
2. Sokratel abstracts FPGA and embedded complexity into a scalable software platform
3. Supports critical infrastructure, including wind energy and next-generation renewable systems
4. Scales beyond wind turbines to automotive, robotics, and industrial automation applications

CHALLENGES

Sokratel needed a deterministic, real-time control platform capable of supporting high-frequency control loops, precise synchronization, and multiple workloads operating at different time scales on a single device.

SOLUTION

SIRIUS OS, powered by AMD Zynq™ UltraScale+™ MPSoC, provides a unified, real-time embedded platform that combines programmable logic and multicore processing with automated MATLAB® Simulink® integration.

RESULTS

With AMD Zynq™ UltraScale+™ MPSoC devices, Sokratel enables multi-rate control, sub-microsecond synchronization, and fast deployment for renewable energy and industrial automation systems.

AMD TECHNOLOGY AT A GLANCE

AMD Zynq™ UltraScale+™ MPSoC

TECHNICAL CHALLENGES

Modern industrial control systems, particularly those used in renewable energy and large-scale automation, must meet strict real-time synchronization requirements. In large wind turbines, control systems must operate with extremely low latency while maintaining precise synchronization across multiple distributed inverter units. Control loop frequencies can reach several hundred kilohertz, while timing jitter must be kept within tens of nanoseconds to ensure stable grid interaction.

At the same time, these systems often run multiple workloads with different timing requirements. Time-critical power electronics control may require nanosecond-level precision, while supervisory control, diagnostics, and communication tasks operate on microsecond or millisecond time scales. Consolidating these workloads on a single platform introduces complexity in scheduling, communication, and resource isolation.

Another challenge arises from the growing use of model-based design. Many control engineers develop algorithms in MATLAB Simulink but translating these models into hardware-ready FPGA designs and embedded software can be time-consuming and error-prone without an integrated workflow.

SOLUTION

The company addressed these challenges by building SIRIUS OS, a real-time, embedded software platform powered by AMD Zynq UltraScale+ MPSoC devices. The platform uses programmable logic for time-critical control while running higher-level tasks on multicore processors, enabling consistent, real-time operation of applications on a single device.

“Our customers wanted a convenient way to have all applications that run with different time scales integrated on a single device,” said Jongmanns. “The AMD Zynq UltraScale+ MPSoC provides a convenient way to handle all of these time scales on a single device.”

SIRIUS OS further simplifies development by integrating directly with MATLAB Simulink, enabling control engineers to deploy designs without deep FPGA or embedded software expertise.

“With our SIRIUS software, we get rid of that

complexity,” Jongmanns said. “You simply click on one button, and the model can be transferred to the different cores, where they can interact with each other on the AMD device.”

In addition to model deployment, SIRIUS OS provides capabilities such as real-time task scheduling, inter-core communication, secure boot, remote firmware updates and support for integration with various IoT platforms. Moreover, deterministic industrial communication is supported via time-sensitive networking by incorporating the AMD TSN Subsystem LogiCORE IP.



These features are critical for industrial automation and energy infrastructure systems that require reliability and long-term maintainability.

RESULT

Together, AMD Zynq UltraScale+ MPSoCs and Sokratel SIRIUS OS have delivered measurable benefits for Sokratel and its customers across renewable energy and industrial automation applications.

“Modern wind turbines require extremely fast, deterministic, and reliable control systems,” Jongmanns said. “With Zynq MPSoC devices and Sirius OS, we can meet these requirements while still enabling flexibility and scalability.”

By consolidating multiple real-time workloads on a single device, customers can reduce system complexity while maintaining deterministic system behavior.

Time-critical control functions were implemented in programmable logic, while higher-level supervisory and communication tasks run on the processing system, allowing workloads with different timing requirements to operate concurrently.

Integration with MATLAB Simulink reduces the effort required to move from model-based design to deployed hardware. Automated generation of FPGA logic and embedded software enable faster iteration cycles and reduced reliance on specialized FPGA expertise, allowing teams to focus on control algorithm development.

In wind energy applications, the solution enabled sub-microsecond synchronization across distributed inverter units – an essential requirement for stable grid connection.

Beyond wind turbines, Sokratel has applied the same platform to automotive, robotics, motion control, and industrial networking applications, supporting broader adoption with a common hardware and software foundation.

Learn more about AMD Zynq™ UltraScale+™ MPSoCs [here.](#)

ABOUT SOKRATEL

For more than 30 years, Sokratel has been developing complex and sophisticated solutions for the technological challenges of tomorrow's world as an engineering partner of renowned industrial companies. The company supports leading industrial customers with a broad range of competencies. Learn more [here.](#)

ABOUT AMD

For more than 50 years AMD has driven innovation in high-performance computing, graphics, and visualization technologies. Billions of people, leading Fortune 500 businesses, and cutting-edge scientific research institutions around the world rely on AMD technology daily to improve how they live, work and play. AMD employees are focused on building leadership high-performance and adaptive products that push the boundaries of what is possible. For more information about how AMD is enabling today and inspiring tomorrow, visit the AMD (NASDAQ: AMD) website, blog, LinkedIn, and Twitter pages.

ENDNOTES

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