

# SOC-E POWERS EFFICIENT, RELIABLE SMART GRIDS AND ENERGY INFRASTRUCTURE NETWORKS WITH AMD ADAPTIVE SoCs

*SOC-E's AMD-based IP cores and modules enable smooth, high-availability communication and synchronization to optimize digital substation operations*



The evolution from conventional, analog electrical power stations to modern digital substations has brought major improvements in efficiency, reliability, and intelligence for smart grids and industrial infrastructure. These attributes are essential for utilities and industrial operators distributing power to communities and customers, and stringent industry standards have arisen to minimize the risk of downtime and data loss in these critical energy-delivery applications.

[SOC-E](#) (Spain) has emerged as a leader in the design of IP cores and modules for networking equipment enabling high performance, redundancy and precise time synchronization to meet the requirements of the [IEC 61850:2025 SER | IEC](#) global standard for interoperable communication between electrical substations. Key capabilities like HSR (High-availability Seamless Redundancy), PRP (Parallel Redundancy Protocol) and IEEE 1588 PTP (Precision Time Protocol) are crucial to these solutions, and customers count on SOC-E's expertise and innovation to make these integrations seamless.

SOC-E's SMARTzynq and SMARTmpsoc pluggable System-on-Modules (SoMs), based on AMD Zynq™-7000 SoCs and AMD Zynq™ UltraScale+™ MPSoCs, respectively, streamline the implementation of customized Ethernet networking designs for the electric, industrial automation, transportation and aerospace sectors. SOC-E's solutions, deployed globally, are helping to modernize electrical grid infrastructure for new levels of efficiency, reliability and automation.

## CHALLENGE

With energy delivery demands intensifying, digital subsystem operators need to move quickly and strategically when implementing standards-compliant networking infrastructure. But operators can struggle with the complexity and specialized expertise required to implement high-availability networking protocols like HSR, PRP and PTP. Upfront hardware-level integration helps customers achieve the requisite performance and reliability without the development complexity and cost penalties they'd incur with ad hoc approaches.

For IEC 61850 device OEMs, including protection relays and standalone merging units, a SoM-based approach can help reduce the board-level integration effort by combining pre-validated Ethernet redundancy (HSR/PRP) and precise time synchronization (IEEE 1588 PTP) in a field-validated module. OEMs can pair the module with a carrier board tailored to device-specific I/O, mechanics and certification requirements while maintaining a repeatable latency, failover and synchronization profile across product variants. This approach can help shorten development timelines and reduce integration risk. Firmware and IP configuration updates can also help limit the need for full board redesigns as requirements evolve.

## INDUSTRY

Smart Grids & Industrial Networking

## CHALLENGES

Digital substations and industrial infrastructure require networks built for reliability, precision and efficiency. SOC-E sought a flexible FPGA processing platform for implementing high-availability networking protocols with support for seamless redundancy, sub-microsecond synchronization and deterministic performance needed in IEC-61850 standard environments.

## SOLUTION

SOC-E's SMART Series Modules, powered by AMD Zynq™-7000 SoCs and AMD Zynq™ UltraScale+™ MPSoCs, help customers implement time-sensitive networking with ease. These solutions provide deterministic processing to help ensure ultra-low latency, precise synchronization and reliable packet delivery, with conformance to IEC-61850.

## RESULTS

Leveraging AMD Zynq™ Series solutions, SOC-E integrates hardware-based implementations of exacting protocols including HSR (High-availability Seamless Redundancy), PRP (Parallel Redundancy Protocol) and PTP (Precision Time Protocol) for customer implementations in critical digital substation infrastructure, achieving higher performance levels vs. software-only solutions.

## AMD TECHNOLOGY AT A GLANCE

AMD Zynq™-7000 SoC and AMD Zynq™ UltraScale+™ MPSoC



“Energy sector clients in the IEC-61850 ecosystem trust SOC-E for the unrivaled depth of experience we bring in high availability networking protocols for Ethernet-based communications. Our in-house expertise implementing stringent resiliency standards and time sensitive networking (TSN) is a major asset to clients,” said David Modroño, SocTek business manager at SOC-E. “There’s no room for compromise in these designs. Our clients provide the key components responsible for powering critical energy infrastructure, and they seek a faster time to deployment with robust and reliable connectivity that can easily scale.”

Conventional software-based and discrete hardware approaches often fall short of delivering the ultra-low latency, seamless redundancy and precise synchronization demanded by standards like IEC-61850. SOC-E was founded 15 years ago to answer these challenges, with a clear mission to deliver cutting-edge Ethernet-based networking and synchronization solutions leveraging FPGA technology.

“From the beginning, AMD (formerly Xilinx) devices have been the cornerstone of our product strategy,” Modroño said.

**SOLUTION**

SOC-E provides a comprehensive and field-proven IP core suite for HSR, PRP and PTP, fully optimized for AMD adaptive SoCs. SOC-E’s modules are intended for OEMs and system integrators building IEC 61850-compliant substation devices such as protection relays and standalone merging units. The approach can fit teams with limited in-house FPGA resources, as well as experienced FPGA teams that want to focus on application differentiation rather than rebuilding redundancy and timing functions. It can support organizations seeking a repeatable platform that can scale across product variants.

The company enables customers to accelerate integration and deployment by offering custom, application-specific configurations of its IP cores embedded across our SMART Modules portfolio. This requires a high level of firmware flexibility and programmability enabled in its architecture, optimized and validated for industrial-grade hardware.



SOC-E’s SMARTzynq and SMARTmpsoc pluggable SoMs leverage AMD Zynq™-7000 SoCs and AMD Zynq™ UltraScale+™ MPSoCs, respectively, and are delivered preloaded with capabilities that are carefully tailored for digital substations operating under the IEC-61850 standard. “AMD adaptive SOCs are the ideal platform for implementing deterministic, high-availability and time-aware Ethernet solutions,” Modroño said. “The rich tool chain, robust documentation and long-term device availability offered by AMD were critical in helping us bring to market a reliable IP portfolio and scalable module solutions.

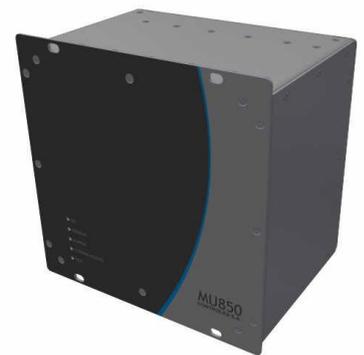
“AMD offers the best combination of performance, reliability, ecosystem maturity and development tools, with the flexible solutions SOC-E needs to build a scalable product roadmap – all while maintaining a consistent development flow and ecosystem,” Modroño added. “As a result, we made an early and strategic decision to focus exclusively on AMD platforms to power our SMART SoM portfolio.”

**RESULTS**

“The best measure of SOC-E’s success is the success of our customers,” Modroño said. “We’ve achieved hundreds of successful deployments worldwide, partnering with innovative customers like Controles S.A. and Zakład Produkcyjny Aparatury Elektrycznej Sp. z o.o. (ZPrAE) among many others, both of which are playing leadership roles in achieving smarter, greener electrical grids.”

[Controles S.A.](#) (Uruguay) specializes in the design, manufacturing and commercialization of electronic equipment throughout Latin America. Its MU850 Merging Unit solution bridges communication between the physical power system and the digital communication network within the substation, making it possible to architect fully digital, time-synchronized protection and control systems. With AMD adaptive SOCs at the heart of the MU850, it enables synchronization accuracy of less than 4 microseconds and maximum processing delay of just 2 milliseconds.

[ZPrAE](#) (Poland) produces protection devices and automation panels for power grid applications, including solutions such as the TMU-11 Merging Unit shown below. In a digital substation, a protection device detects electrical faults and abnormal conditions in the grid and acts quickly to isolate the problem, preventing damage to equipment and maintaining the stability of the power system.



*Figure 1 MU850 Merging Unit – Controles S.A.(Uruguay)*



Figure 2TMU-11 Merging Unit – ZPrAE (Poland)

The AMD adaptive SoCs onboard SOC-E’s SMART Modules help ZPrAE enable redundant network connections and precise time synchronization that support deterministic protection performance and uninterrupted operation of critical substation systems.

“The flexibility of AMD adaptive SoCs is essential for our products and the digital substations they’re ultimately built into,” Modroño said. “The critical technologies that SOC-E works with are in constant development and standardization. AMD’s technology and support ecosystem allows us to adapt, upgrade and extend features over time – without needing to redesign entire systems from scratch.

“This capability ensures that our solutions are future-ready and versatile, addressing a wide range of customer needs with a single, scalable hardware platform. Partnering with AMD has played a key role in SOC-E’s growth and success, and our journey with AMD continues to open new opportunities.”

**Want to learn more?**

[About AMD Zynq™-7000 SoCs](#)

[About AMD Zynq™ UltraScale+™ MPSoCs](#)

**ABOUT SOC-E**

SOC-E is a leading technology provider for high-availability and deterministic networking, sub-microsecond synchronization and cybersecurity solutions for critical sectors. The company delivers in-house developed IP cores, electronic modules and end equipment in over 200 deployments worldwide. These projects span various sectors including Electric, Aerospace and Defense, Industrial Automation, Automotive and more. [www.soc-e.com](http://www.soc-e.com)

**ABOUT AMD**

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