SIPEARL

The role of SiPearl's CPUs

in the ARM ecosystem and the RISER Project

White Paper

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1 Market opportunities for ARM-based CPUs in the cloud

The semiconductor industry, which powers a wide range of modern technologies from smartphones to supercomputers, is forecasted to grow significantly despite challenges such as supply chain disruptions and geopolitical tensions. By 2028, the market size is projected to exceed $600 billion, with a Compound Annual Growth Rate (CAGR) of 8%, Figure 1.

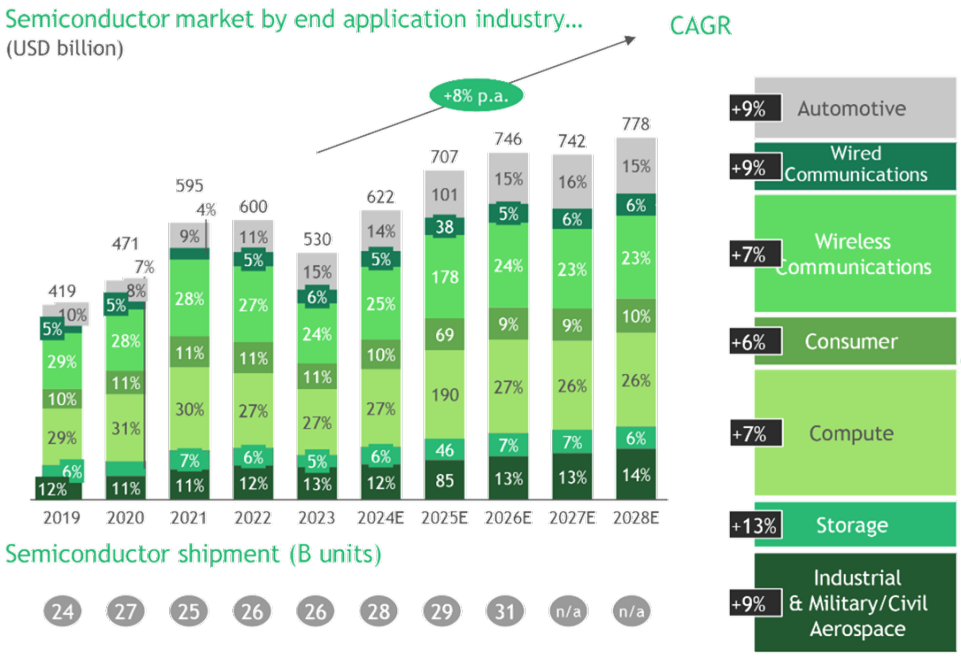

Figure 1: Semiconductor market, source Gartner research and Boston consulting group

The compute segment, which includes server CPUs and accelerator cards, represents approximately 26% of the total market and is expected to grow by 7%, driven by the increasing need for efficient and scalable server solutions due to the explosion of data generation.

ARM CPUs are particularly well-suited to meet this demand, thanks to their power efficiency and performance-per-watt. Market analysts predict that ARM-based CPUs will capture 20% of the data center market share by 2028, driven by adoption from major cloud service providers such as AWS, Microsoft, and Google. Geopolitical and supply chain considerations have also accelerated the adoption of ARM-based CPUs, as companies and governments seek to diversify their supply chains and reduce dependency on single suppliers. The push for technological sovereignty, especially in Europe, has further spurred investment in ARM-based development projects, positioning ARM CPUs as a key component in creating a resilient and autonomous technology infrastructure.

With the growing demand for more powerful and efficient chips in the semiconductor industry, the need for energy-efficient solutions has never been more urgent.

2 ARM ecosystem and SiPearl's role in it

The significant growth in data, primarily driven by AI needs and the increasing reliance on cloud services, has led to a surge in data center power consumption, which is forecasted to rise to about 3,000 TWh by 2030, Figure 2. This increase has highlighted the need for energy-efficient solutions, with ARM CPUs emerging as a compelling alternative due to their superior power efficiency and performance-per-watt compared to traditional x86 processors.

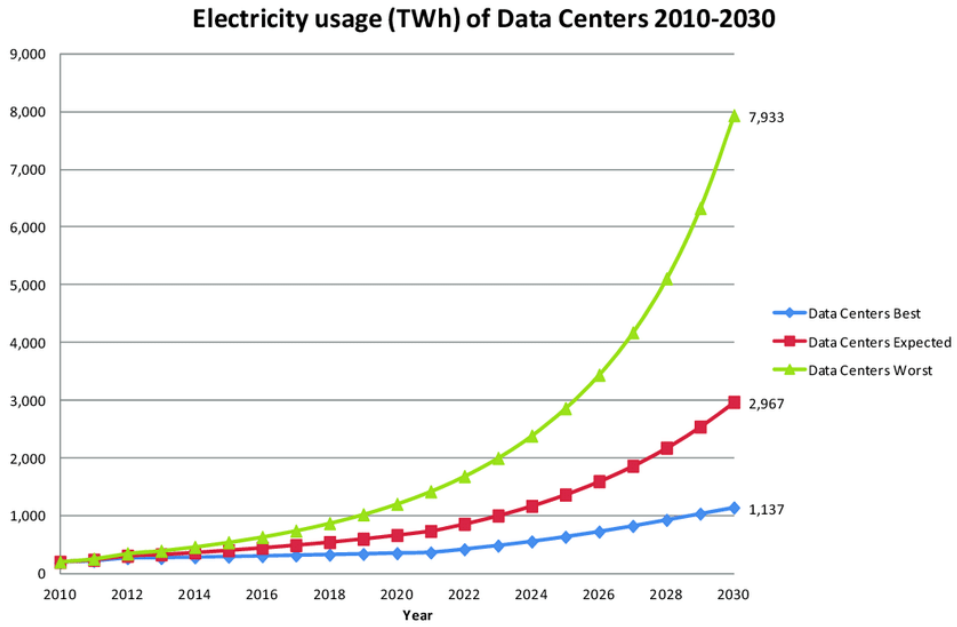

Figure 2 : prediction of datacenter power consumption, i [2]

The ARM ecosystem has steadily grown, providing a robust alternative to x86 architecture, especially in server environments. SiPearl, a European innovator, is distinguished by its high-performance, low-power processors optimized for supercomputing and AI. These processors, designed for memory-bound workloads, are backdoor-free and fully auditable, making SiPearl a strong contender in the European AI market. Since 2008, ARM-based server CPUs have matured across various software ecosystems, now robustly supported by hypervisors like Hyper-V and KVM, operating systems including Linux and Windows, and containerization technologies like Docker and Kubernetes. The server market is predominantly controlled by OEMs such as Dell Technologies, HPE, and Lenovo, which are primarily based in the USA and Asia. Major CPU/GPU suppliers like Intel, AMD and Nvidia are also primarily based in the USA. Both OEMs and CPU/GPU suppliers manufacture their products in the USA or Asia, either internally or with companies such as TSMC and Samsung. This geographical concentration underscores the predominance of high-tech companies outside of Europe.

Ensuring Europe's technological sovereignty involves developing and supporting European players to mitigate risks associated with supply chain disruptions and geopolitical tensions, thereby driving innovation and economic growth. Eviden plays a critical role in the European server market, focusing on high-performance computing solutions. SiPearl designs CPU, collaborating with ARM, Synopsys, and Alphawave, and partnering with OEMs, ODMs, and end-customers to develop optimal architectures. As part of the ARM ecosystem, SiPearl also provides comprehensive software development services, further bridging the gap between design and implementation to ensure innovative and market-aligned solutions.

3 SiPearl's contribution to the RISER Project

SiPearl leverages advancements from the European Processor Initiative (EPI) and EU Pilot projects. The first product, Rhea is an Arm based server processor but leverages RISC-V cores for embedded functions. RISER aims to develop and validate open-source designs for standardized form-factor system platforms suitable for supporting cloud services and deploying cloud applications. This initiative reinforces Europe's strategic autonomy in the semiconductor market. SiPearl's contributions to RISER include developing the Seine platform based on the Rhea processor and integrating it with the Riser PCIe acceleration card. This platform addresses the requirements and use cases defined within the Riser project and is poised for applications in cloud and AI environments. SiPearl's ongoing efforts include developing drivers for the Riser accelerator and evaluating various use cases, with active contributions to the Data Center Security and Control Module (DC-SCM) and the Host Processor Module (HPM).

SiPearl is also actively engaged in the evolution of the Riser program, known as Higher. This initiative focuses on developing open-source designs for high-density rack-scale systems that support cloud and edge services, utilizing ARM CPUs and RISC-V EPAC processors. The Higher program adopts the Open Compute Project (OCP) Server family of standards to build processor modules, aiming to provide modular rack systems with reusable, standards-based infrastructure. This collaborative effort includes 11 partners from industry and academia, driving innovation and securing Europe's position in the global semiconductor landscape.

Within the Higher context, SiPearl aims to develop a dual socket HPM blade based on Rhea2 that could leverage the accelerator developed within the Riser program (see Figure 3).

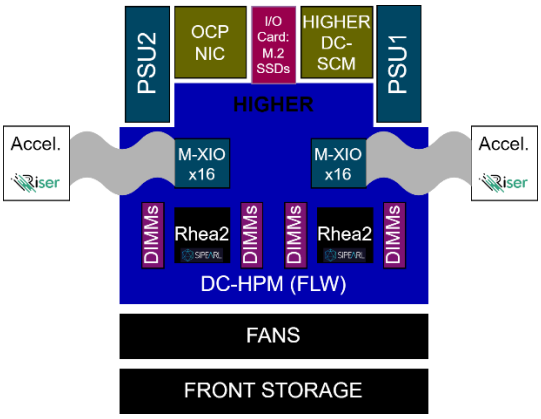

Figure 3 : Example of HPM module with Rhea2 in a double socket configuration

[i] [1] **Impact of Data Centers on Power Consumption, Climate Change, and Sustainability, March 2024, Computational Intelligence for Green Cloud Computing and Digitial Waste Management (pp.60-83) Publisher: IGI Global Publishers, USA**

[i] [2] **Andrae, Anders & Edler, Tomas. (2015). On Global Electricity Usage of Communication Technology: Trends to 2030. Challenges. 6. 117-157. 10.3390/challe6010117.**