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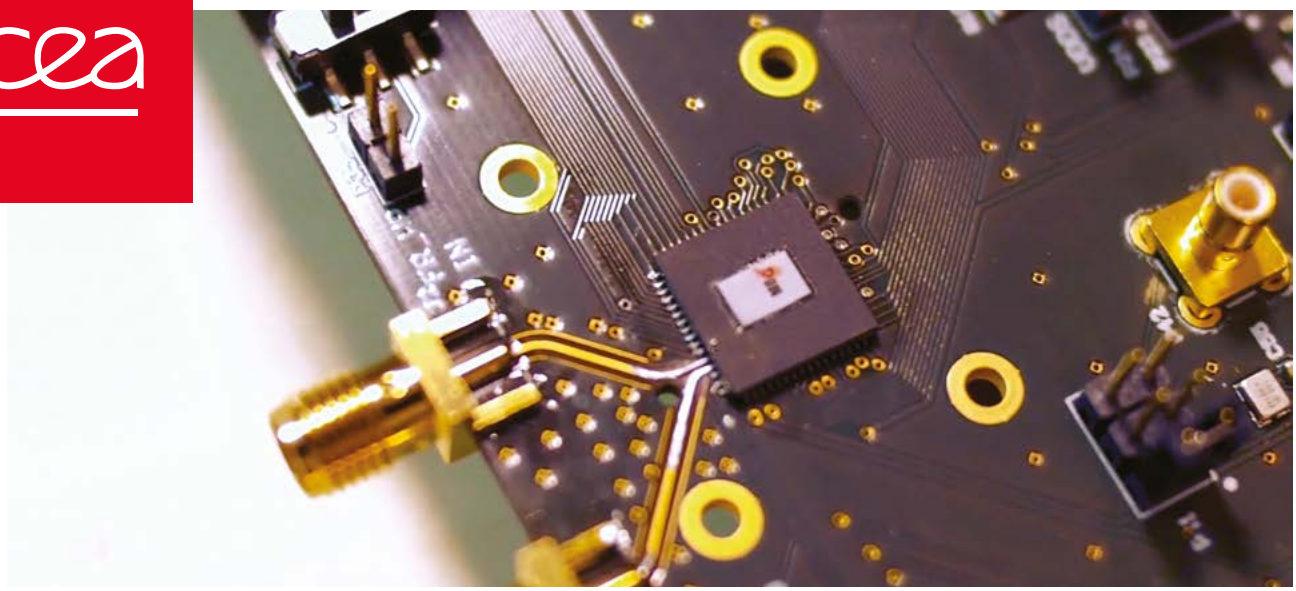


SamurAI

PATENTS 12 PATENTS

Where the Artificial Intelligence (AI) meets the Internet of Things (IoT)

What is SamurAI?

In the near future, millions of sensor nodes (IoT) will collect and share data to address the sustainable environmental and power reduction challenges. These nodes must be extremely power efficient to avoid using batteries while minimizing the communication data. Thus, collecting and processing the data locally with an Artificial Intelligence is the key to address these requirements.

SamurAI is an IoT node in 28 nm FDSOI equipped with:

- **Dual sub-system system**: always responsive and on demand
- **WakeUp Controller (WuC)**: asynchronous low-power core (207 ns wake up time)
- **WakeUp Radio (WuR)**: low-power radio receiver (-73 dBm sensitivity)
- **RISC-V core**: main processor up to 350 MHz and 19pJ/cycle
- **PNeuro**: Artificial intelligence accelerator with 64 processing elements and 1.3 TOPS/W efficiency
- **456kB of SRAM** (where 40 kB with retention)

Applications

- **Smart building**: Activity monitoring, room occupancy
- **Monitoring of parcel transport**: Shock detection
- **Forest surveillance**: Animal counting and classification
- **Health monitoring**: Surveillance of elderly people
- **Advertising impact factor**: Human activity and emotion monitoring

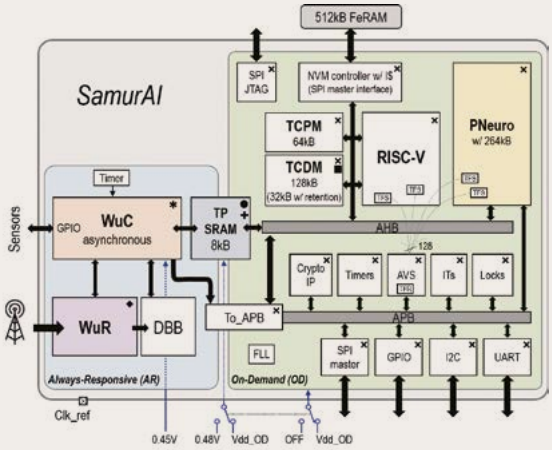
What's new?

The dual sub-system architecture combined with the use of asynchronous logic allows reducing the power consumption of the system while having an extremely fast wakeup time of 207ns (4.8 × better than SoA).
An embedded artificial intelligence accelerator (PNeuro) reaching 1.3 TOPS/W and 36 GOPS (which is 3.5 × and 5.1 × better than the current commercial circuits) is used to process the data locally while preserving the privacy of the information.

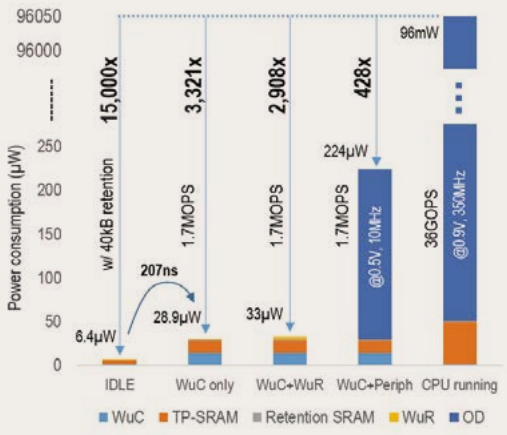
This information can be encrypted with cryptographic accelerator (Crypto IP) to be transmitted. This versatile node is able to address multiple IoT applications with high-energy efficiency, demonstrated with its 15,000 × peak-to-idle power reduction (2.1 × better than current IoT nodes). In a room activity-monitoring scenario, SamurAI slashed the total power consumption of the system (which included a video camera, sensor, and radio module) by a factor of 3 with the dual-subsystem scheme and by a factor of 2.3 when the AI accelerator is used instead of the RISC-V core. The privacy of the data captured was protected.

Key facts

- Presented in Symposia on VLSI Technology and Circuits in 2020
- Received a "Best IP Presentation Award" in DAC conference, 2017
- SamurAI embeds 12 CEA patents
- Showroom demonstrator



▲ *SamurAI system architecture, with always-pesponsive and on-demand sub-systems*



▲ *Power consumption measurements and reduction w.r.t. power modes*

What's next?

SamurAI is a technological demonstration platform to illustrate CEA's knowledge and IPs through an applicative scenario.
Please contact us if you are interested in this platform or its IPs.

Interested in this technology?

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