CPS: Building Highly-efficient and Low-power Edge Computing with Data-driven Learning and Control (Award ID#: CPS-2103459)

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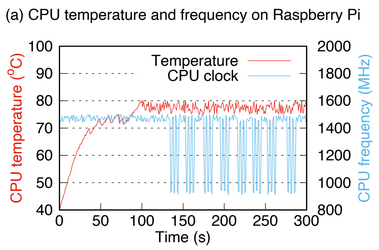
https://www.nsf.gov/awardsearch/showAward?AWD_ID=2103459, https://kevinsuo.github.io/code-lab.html

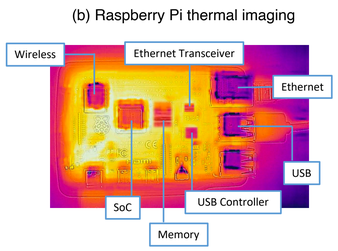
Edge computing becomes more popular but existing cloud solutions lack ideal support and cannot operate effectively in performance and energy-efficiency of edge environments.

- **Challenge 1:** traditional applications are unaware of energy costs, but edge systems is energy-sensitive
- **Challenge 2:** cloud system layers usually isolate, but edge system should dynamically and flexibly interact in a data-driven way

We propose two solutions toward adaptively data-driven infrastructure through learning and control to support highly efficient and low-power consumption services on edge and IoT devices.

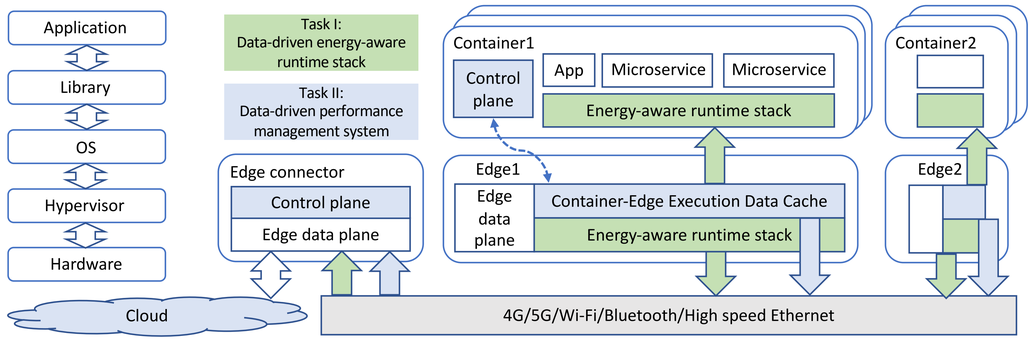
- **Contribution 1:** building a data-driven energy-aware runtime stack to bridge the gap between energy and performance in edge systems
- **Contribution 2:** tailoring edge runtime framework and data plane using a data-driven mechanism to enable efficient communication and interaction among user and kernel space at the edges





This project will generate significant real-world impact in the broad area of edge infrastructure. The understandings, insights, and experiences gained in this research will help improve the key aspects of industry edge infrastructure such as network performance and energy efficiency, which will benefit all cloud and edge systems, applications and services. These experiences will also be extremely valuable to other fields, such as software-defined network, big data systems, and data analytics.

Figure: traditional multi-layered cloud architecture and the overview of proposed two tasks in the edge system.



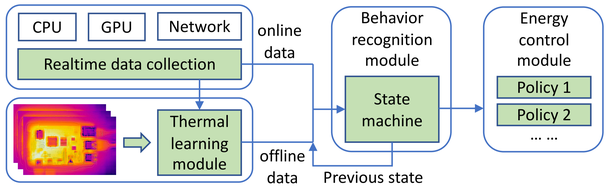


Figure: the full stack of energy perception and control on the edges.

This project focuses on next-generation edge computing platforms, especially virtualized edge computing infrastructure. We will collaborate with researchers from Microsoft and Nvidia Research, also expose students to real cases, and in return align our research with real needs of practitioners.

The results will be integrated in topics and projects in computer system courses (e.g., Operating Systems, etc.). This research will share the results in the Georgia STEM program, local K12 schools or part of STEM discovery camp in KSU SummerU day.

This project will support two Ph.D. students and four undergraduate students. The results will also help the course update and new course development in both undergraduate and graduate schools in KSU.