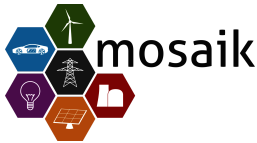
Integrating Ecovisor into Mosaik Co-Simulation

Henrik Nickel Marvin Steinke

Technische Universität Berlin

February 5, 2023



Outline

Technische Universität Berlin

Section 1

Introduction

Carbon-Aware Computing

- data centers' energy consumption is a concern for carbon emissions
- carbon- and renewable-aware computing can optimize efficiency
- **virtual energy systems** and **software defined control** can be used to achieve this

Figure: DALL-E 2 "a tree, growing out of an old computer"

Section 2

Background

Ecovisor

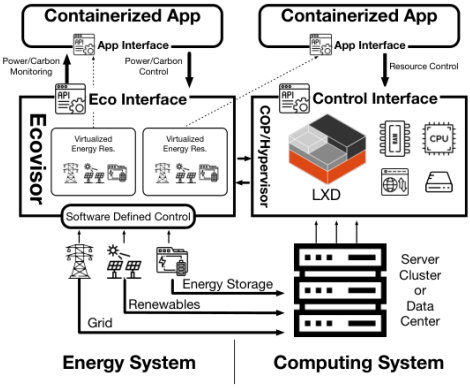


Figure: Ecovisor design (Souza et al. [1])

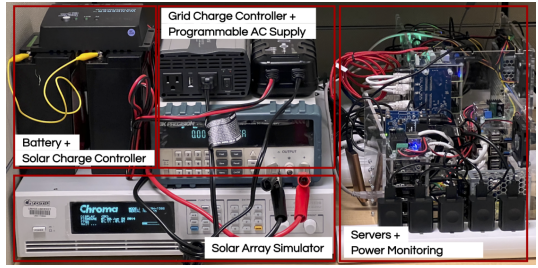


Figure: Ecovisor physical prototype (Souza et al. [1])

Mosaik Co-Simulation

Technische Universität Berlin

- open-source co-simulation framework
- combines multiple simulations to simulate large, complex systems
- enables integration and communication of various simulation models

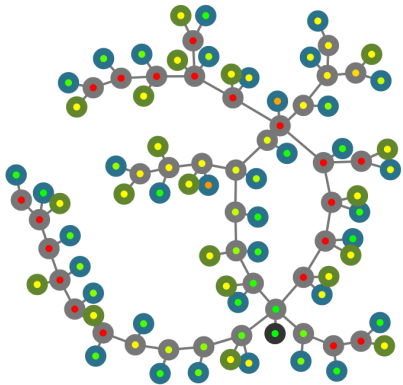


Figure: Smart grid simulation demo

Section 3

Approach

Requirements

Technische Universität Berlin

- original Ecovisor design is abstracted to a model with full functionality
- Ecovisor model is executed within Mosaik
- simulated consumers can access API via Mosaik's interface
- real consumer *outside* the simulation can access API in real time

Design

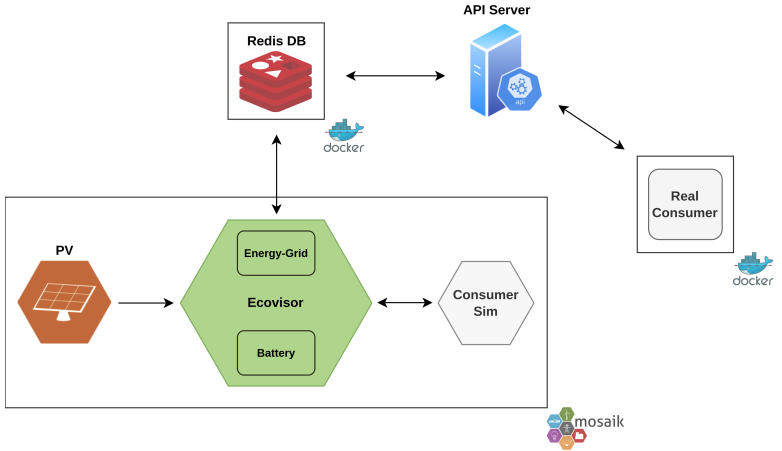


Figure: System design

Demo

Technische Universität Berlin

Hier könnte Ihre Werbung stehen.

Section 4

Evaluation

Evaluation

Future Work

Technische Universität Berlin

- interconnected geo-distributed Ecovisors
  - carbon intensity different from region to region
  - carbon information services such as Electricity Maps[1]

➔ enable carbon-efficiency optimizations such as Let's Wait Awhile or Cucumber from Wiesner et al. [2, 3]

[1] `https://www.electricitymaps.com/`

Section 5

Conclusion

Conclusion

Bibliography

- A. Souza, N. Bashir, J. Murillo, W. Hanafy, Q. Liang, D. Irwin, and P. Shenoy, "Ecovisor: A virtual energy system for carbon-efficient applications," *arXiv preprint arXiv:2210.04951*, 2022.
- P. Wiesner, I. Behnke, D. Scheinert, K. Gontarska, and L. Thamsen, "Let's wait awhile," in *Proceedings of the 22nd International Middleware Conference*, ACM, dec 2021.
- P. Wiesner, D. Scheinert, T. Wittkopp, L. Thamsen, and O. Kao, "Cucumber: Renewable-aware admission control for delay-tolerant cloud and edge workloads," in *Euro-Par 2022: Parallel Processing*, pp. 218–232, Springer International Publishing, 2022.

- title page adapted from `https://mosaik.offis.de/`