



German  
Research Center  
for Artificial  
Intelligence



# An Energy-Efficient Stream Join for the Internet of Things

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# Motivation

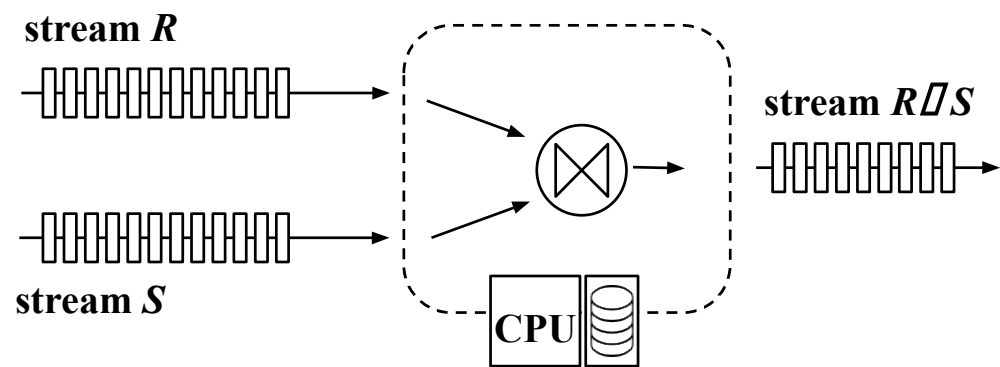


Edge devices  
(Nvidia Jetson Nano)

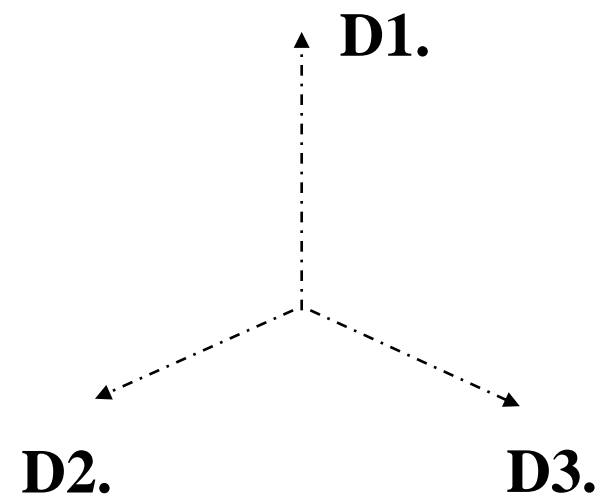
- Reduced compute power
- **Limited energy budget (battery powered)**
- Data stream processing workload
- Heterogeneous hardware

# ecoJoin

## Architecture

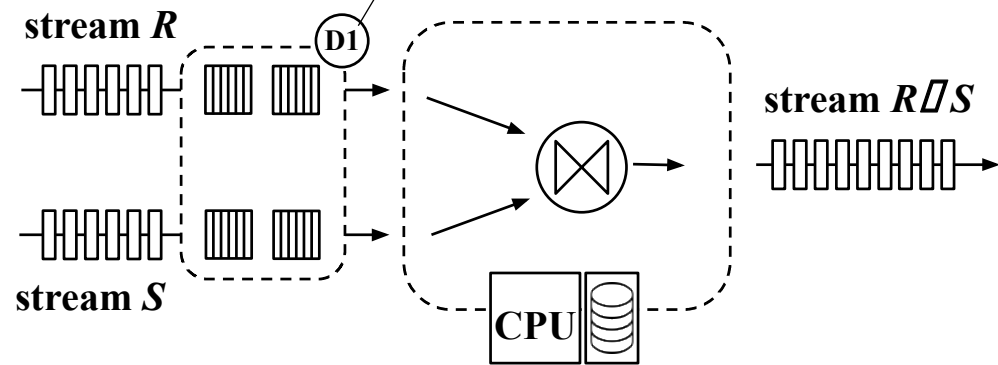


## Dimensions

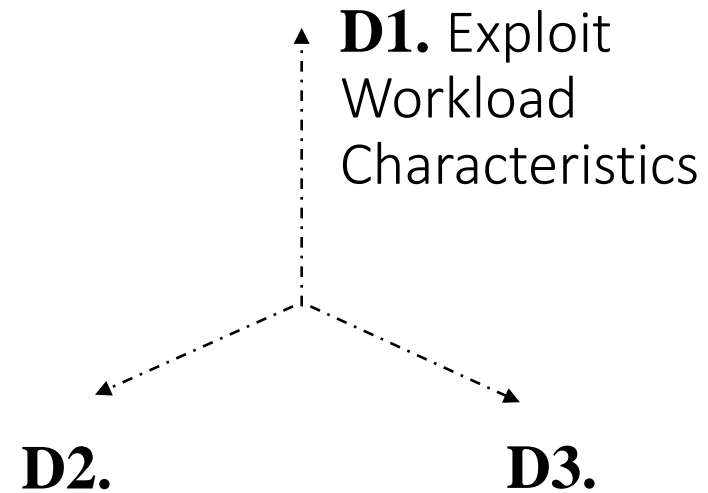


# ecoJoin

- Adaptive batching of stream
- Race-to-idle with optimal clock frequency



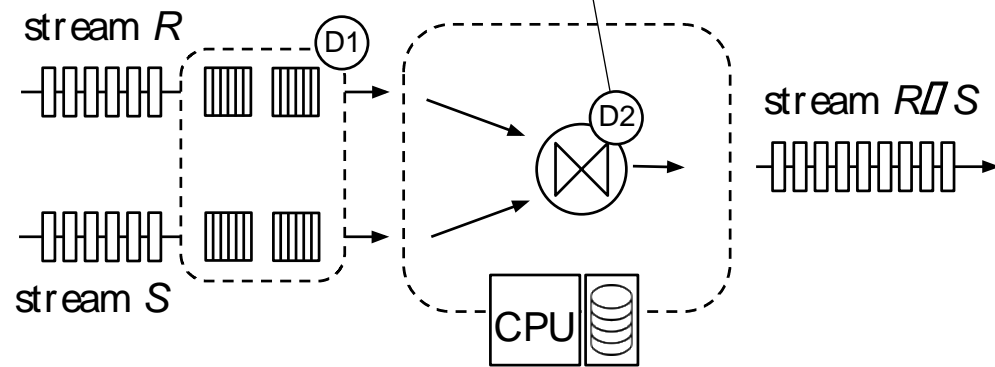
Dimensions



# ecoJoin

- Hash-based stream join
- Fill factor-based garbage collection

Dimensions



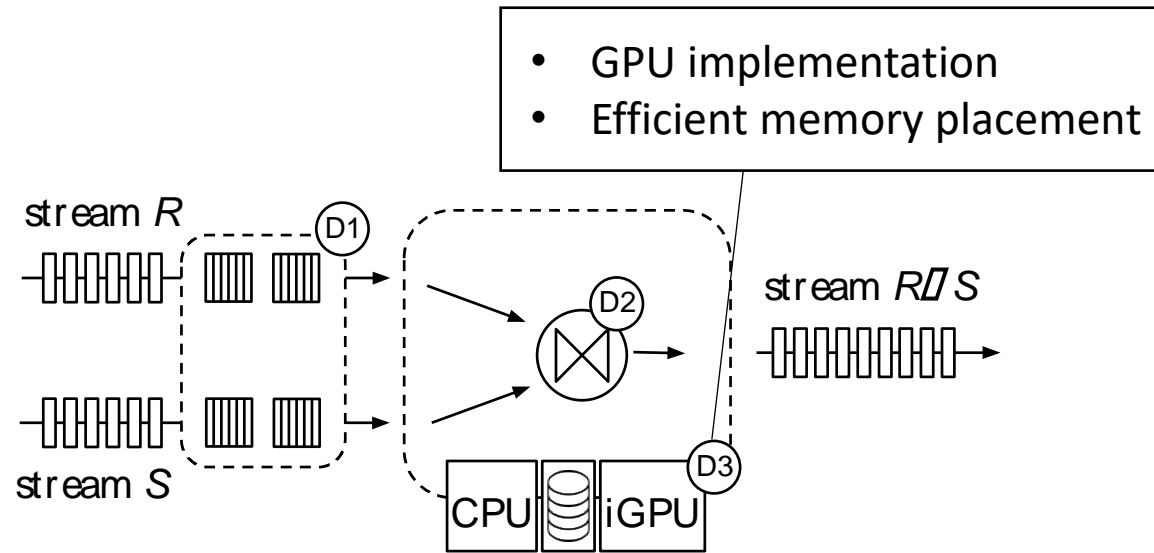
**D1.** Exploit Workload Characteristics

**D2.** Reduce Computational Complexity

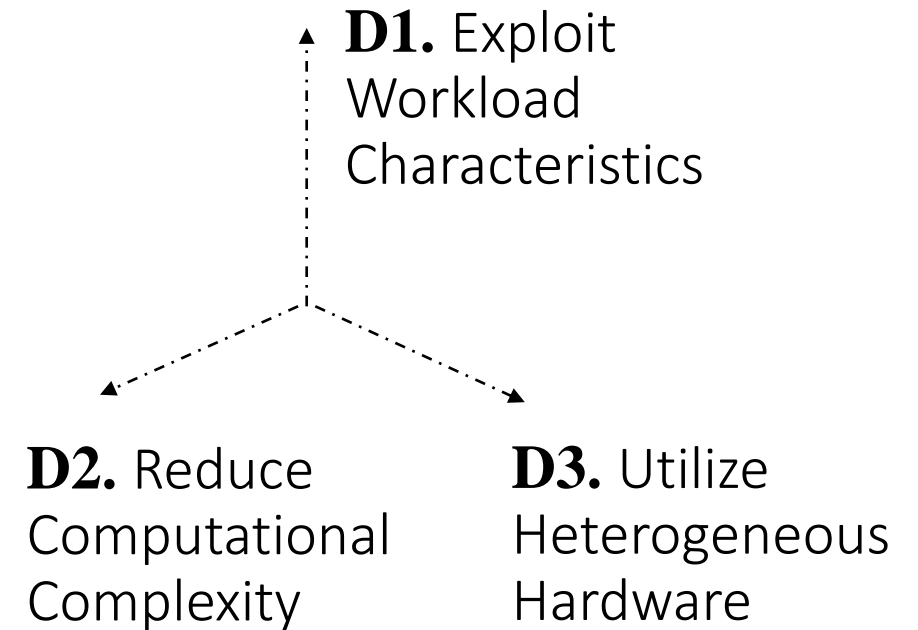
**D3.**

# ecoJoin

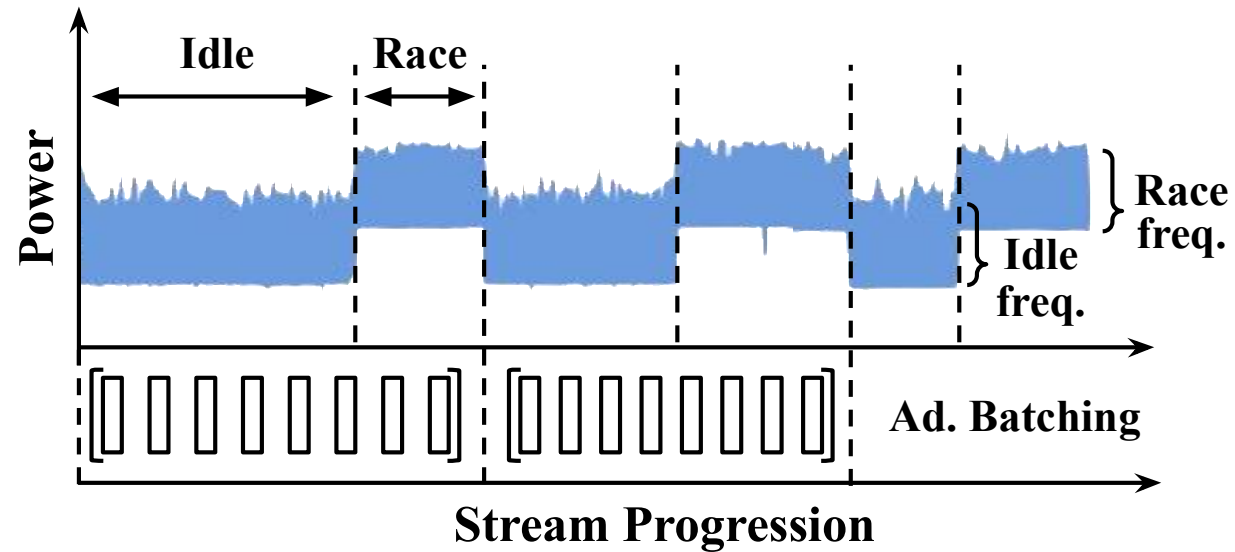
## Architecture



## Dimensions

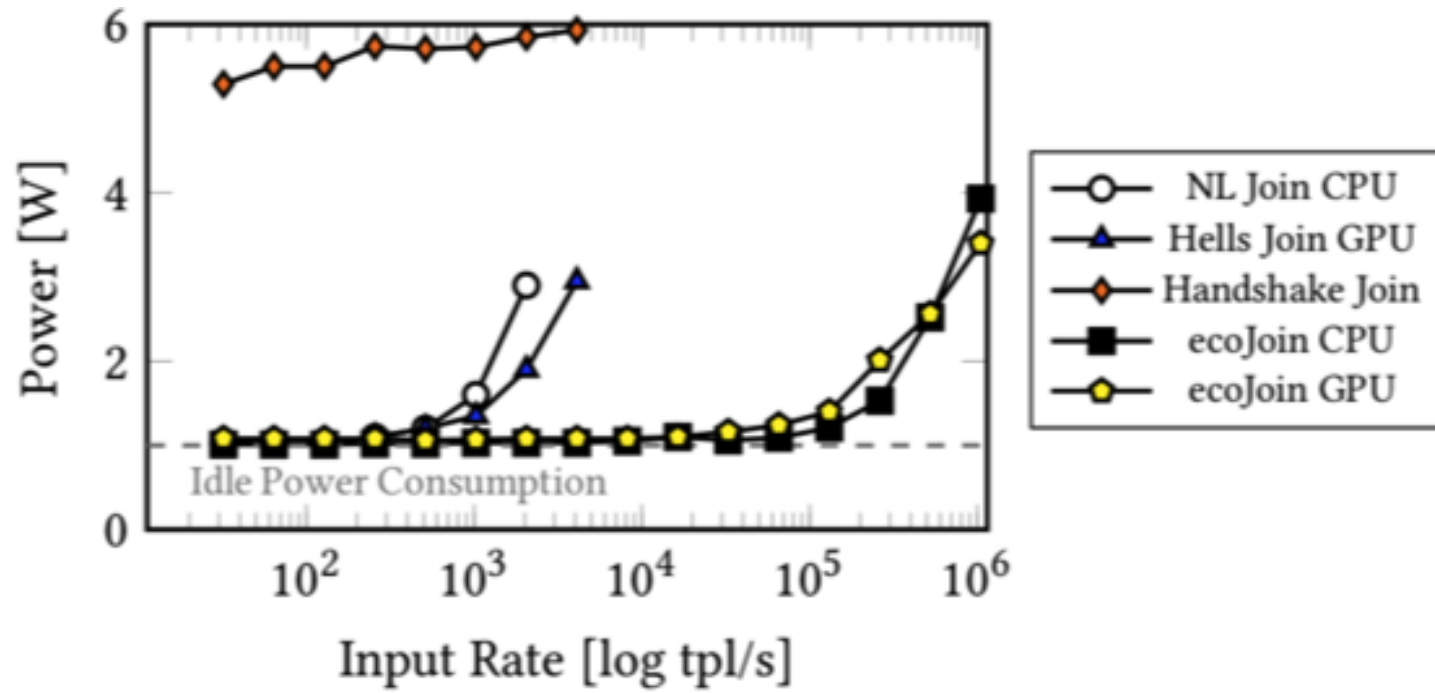


# D1. Workload Characteristics



- Energy saving factors:
- Adaptive batching → cache locality
  - Optimal frequency selection

# Evaluation



*ecoJoin outperforms state of the art stream joins in throughput and power consumption*



# Conclusion

We explore energy-efficient stream processing for the IoT:

1. Exploit workload characteristics
2. Reduce computational complexity
3. Utilize heterogeneous hardware

Next steps:

incorporate ecoJoin into our NebulaStream platform



Paper:



<https://doi.org/10.1145/3465998.3466005>

Github:



<https://github.com/TU-Berlin-DIMA/ecoJoin>

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