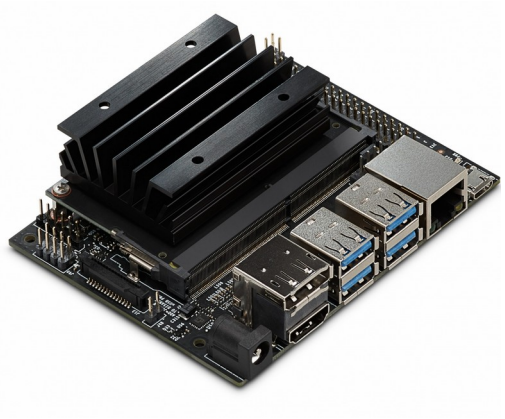
An Energy-Efficient Stream Join for the Internet of Things

Adrian Michalke, Philipp M. Grulich, Clemens Lutz,
Steffen Zeuch, Volker Markl

Motivation



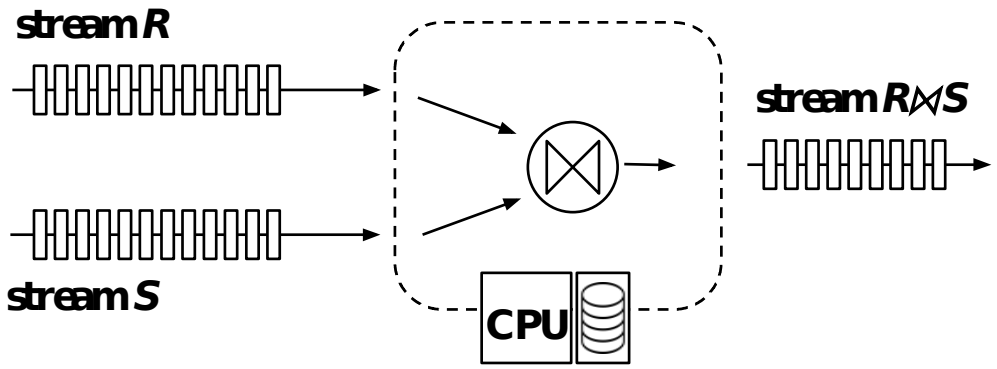
Edge devices
(Nvidia Jetson Nano)

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

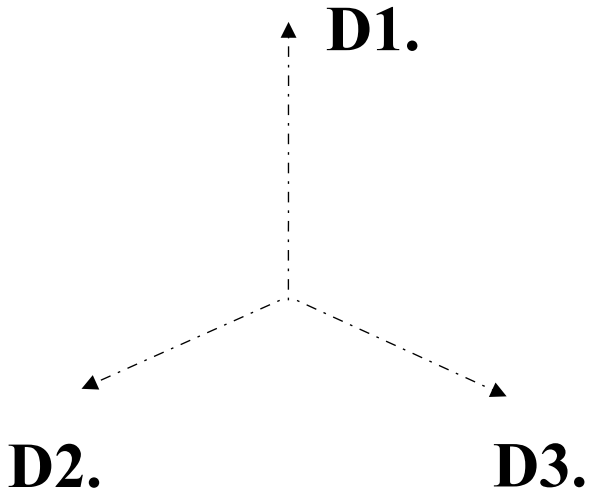
image source:
https://developer.nvidia.com/embedded/jetson-nano-developer-kit

ecoJoin

Architecture

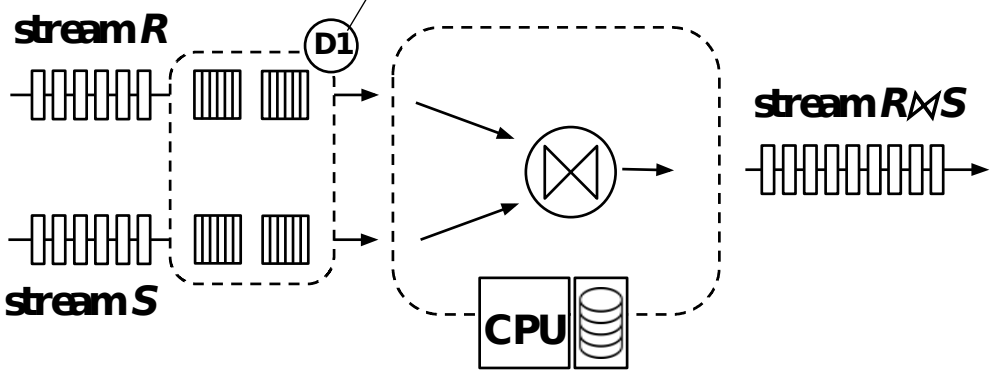


Dimensions



ecoJoin

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



Dimensions

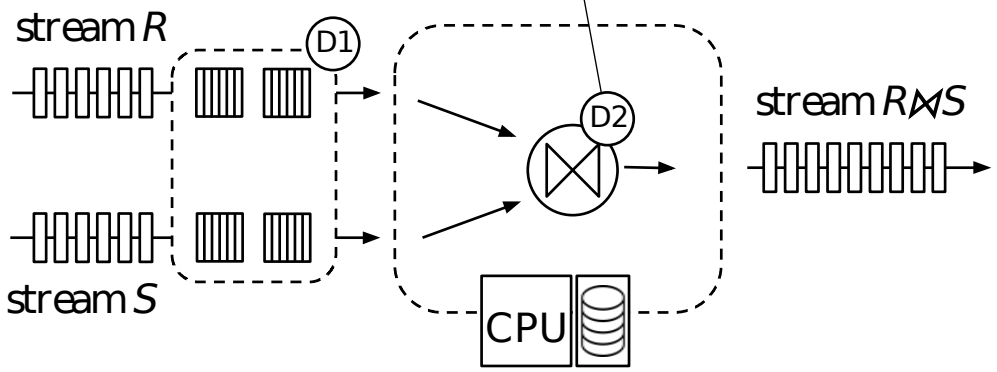
D1. Exploit Workload Characteristics

D2.

D3.

ecoJoin

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



Dimensions

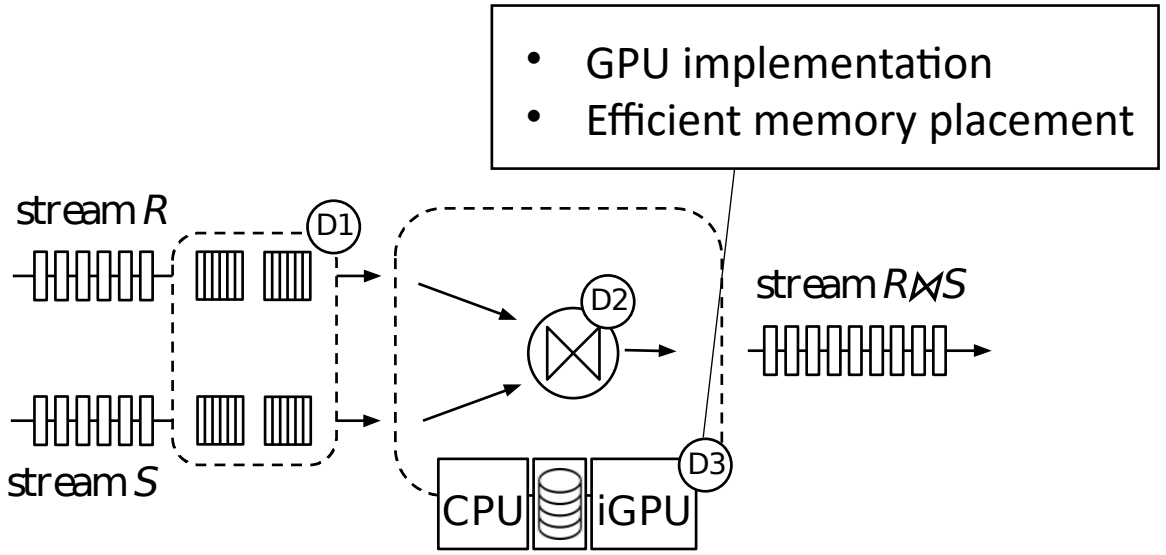
D1. Exploit Workload Characteristics

D2. Reduce Computational Complexity

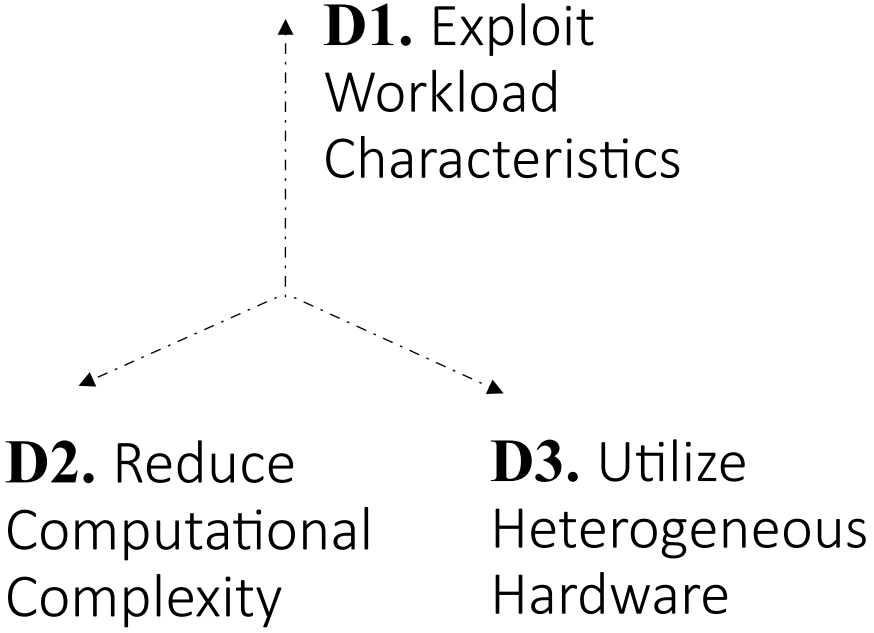
D3.

ecoJoin

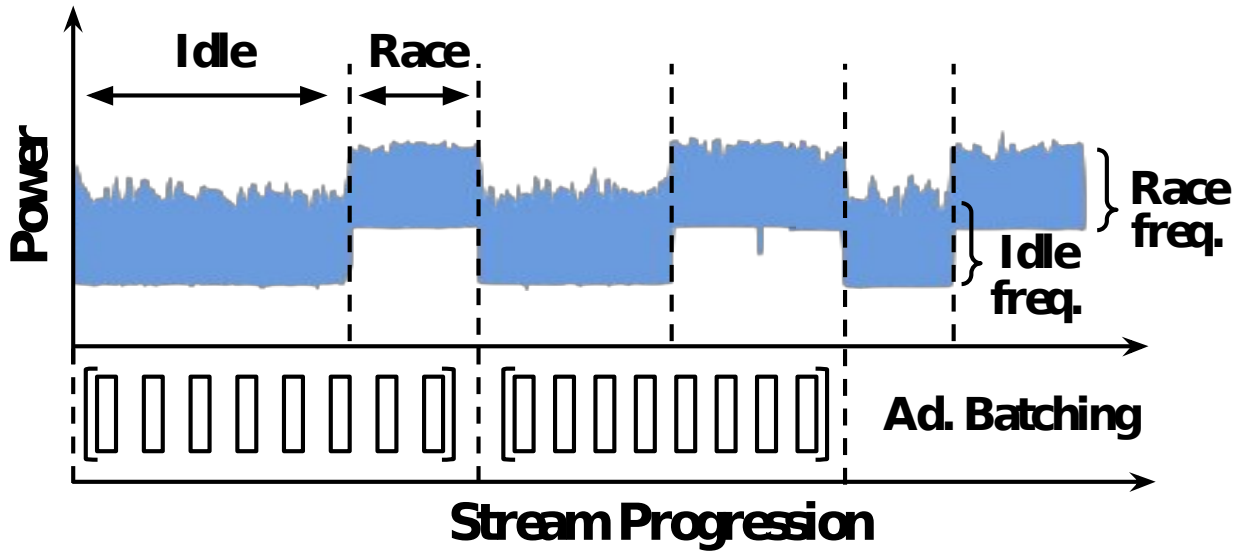
Architecture



Dimensions



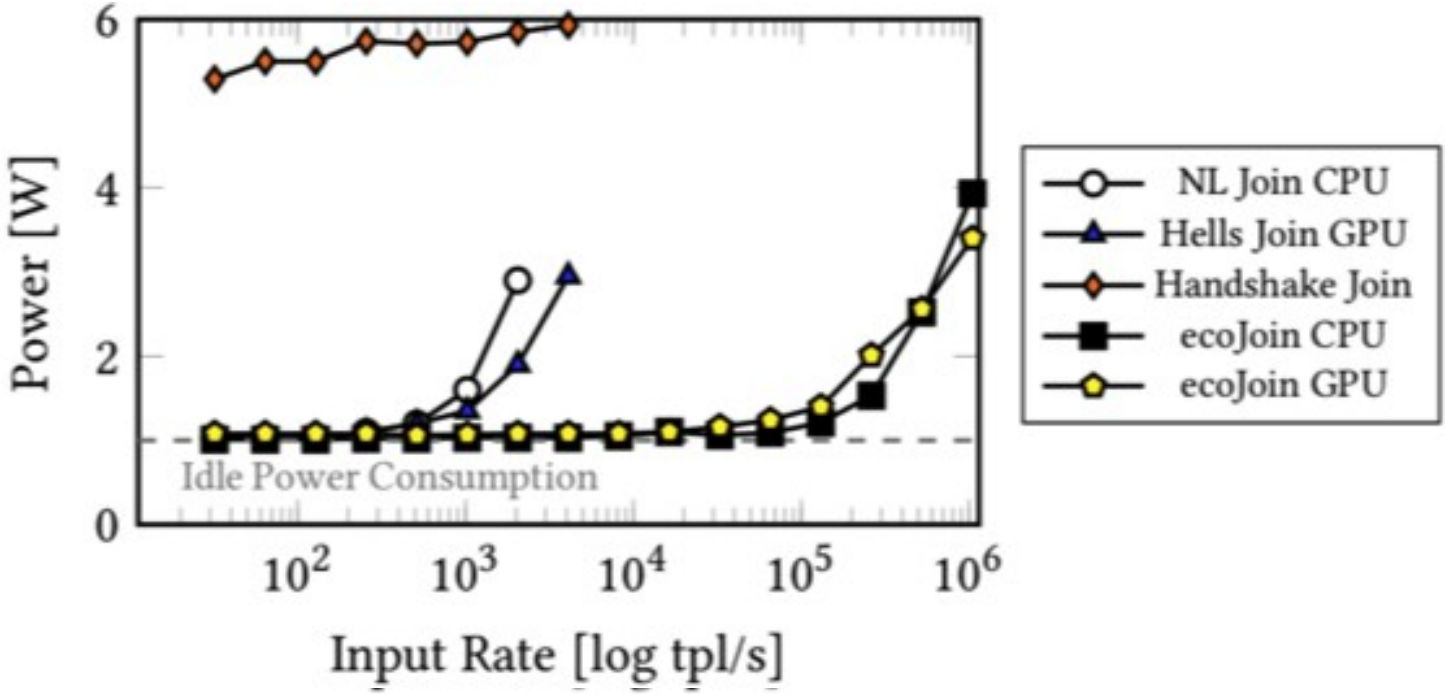
D1. Workload Characteristics



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:
incorperate ecoJoin into our NebulaStream platform

Paper:

https://doi.org/10.1145/3465998.3466005

Github:

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

Email: adrian.michalke@dfki.de