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Integrate Life Cycle Assessment in design flow with Appa LCA

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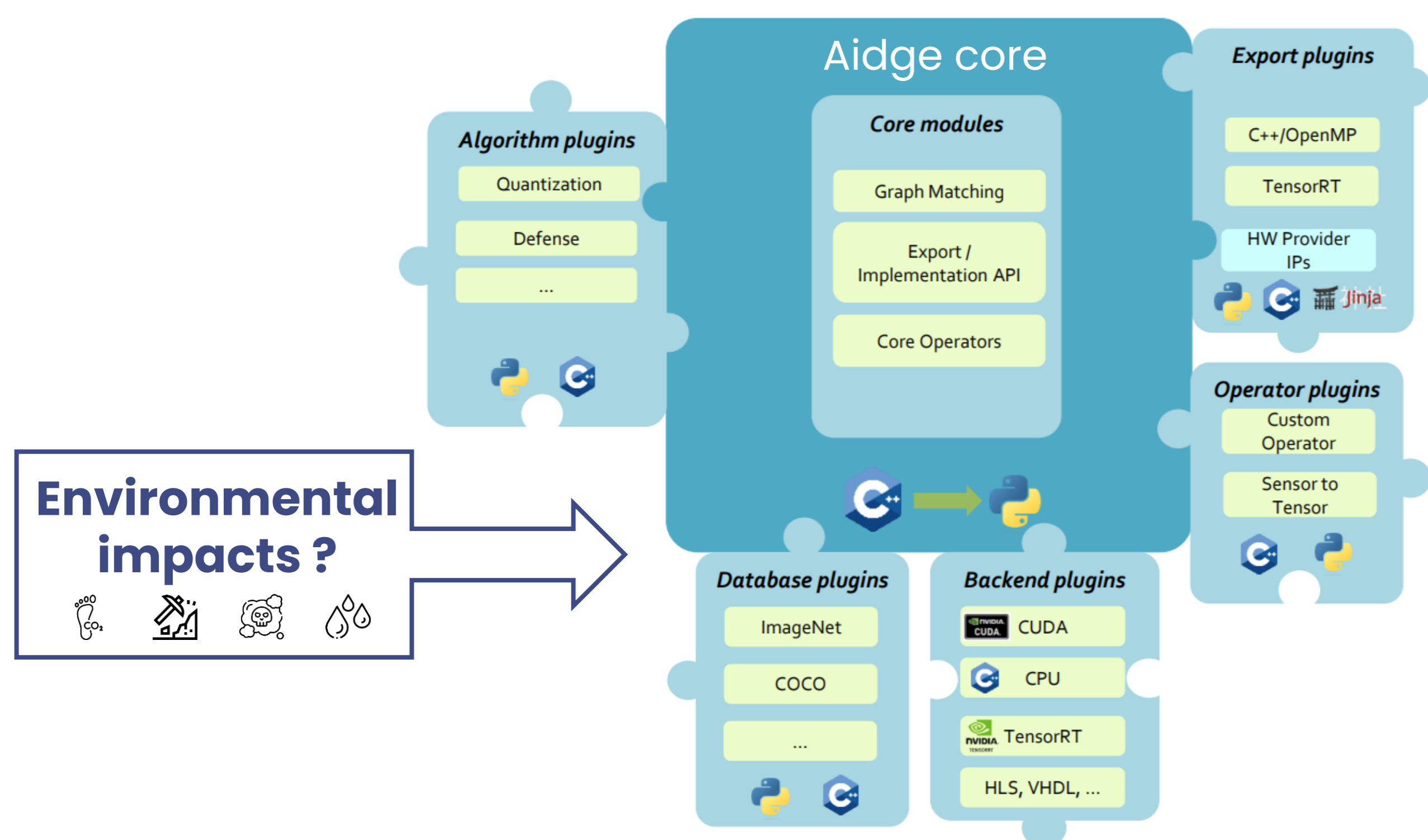
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Integrate Life Cycle Assessment in design flow with Appa LCA

Context



Objective

- Eclipse Aidage = platform for embedded AI development and integration
- Life Cycle Assessment (LCA) = preferred method for environmental impacts computation
- How to perform LCA in a design platform to enable eco-design?**

Problems

Difficulties to embed or interface LCA software with Aidage

- Lack of Application Programming Interface (API)
- Heavy, complicated to use, need for LCA databases

➔ To ease integration of LCA in design platform, we propose:

Appa LCA: Automatable, Portable and Parametric LCA

Appa LCA framework

Shared in **Open Source**:

<https://github.com/appalca/>



- The **versatility** of LCA software **and** the **simplicity** of ad hoc assessment tools
- Easy to interface** with any **design platform** or flow, on **any application domain**
- Novelty**: decompose LCA software in **two independent tools**

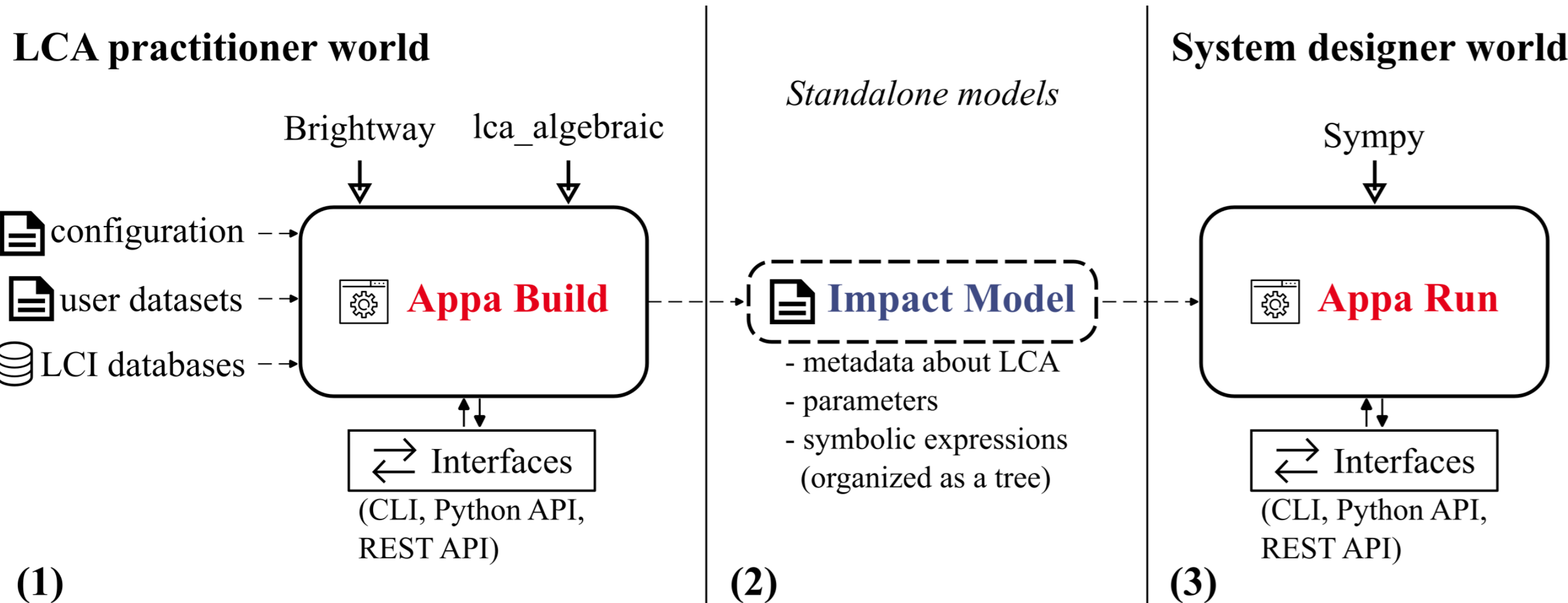
Case-study

Use of Appa LCA to develop Aidage environmental assessment plugin:

- We conducted parametric LCA of embedded AI accelerators to generate impact models (example in Figure 1)
- We connected these impact models to a GUI thanks to Appa Run, which can be used by Eclipse Aidage users (Figure 2)

```
metadata:
  author: Maxime Peralta
  version: 1.2
[...]
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  - name: cuda_core
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  - name: architecture
    options: [Maxwell, Pascal]
[...]
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    (4.6212599075297227e-9*cuda_core + 7.37132179656539e-6) +
    289.6776199311062*architecture_Maxwell [...]
  - EFV3_WATER_USE: [...]
```

Figure 1: Example of an impact model for NVIDIA GPU based AI accelerators built with Appa Build



(1) 1st tool: Appa Build

- Based upon **Brightway**
- Impact data import from any LCI database
- Features to ease parameterization of LCI
- Produces **impact models**

(2) Impact model

Standalone, parametric LCA template (yaml format).
One symbolic expression per impact method.

(3) 2nd tool: Appa Run

- Imports and runs **impact models**
- Lightweight, fast execution
- No software/database dependencies
- Easy to connect with other tools: different APIs, can be customized
- Ready to use results (figure, tables...) and features, such as uncertainty analysis, Sobol indices...

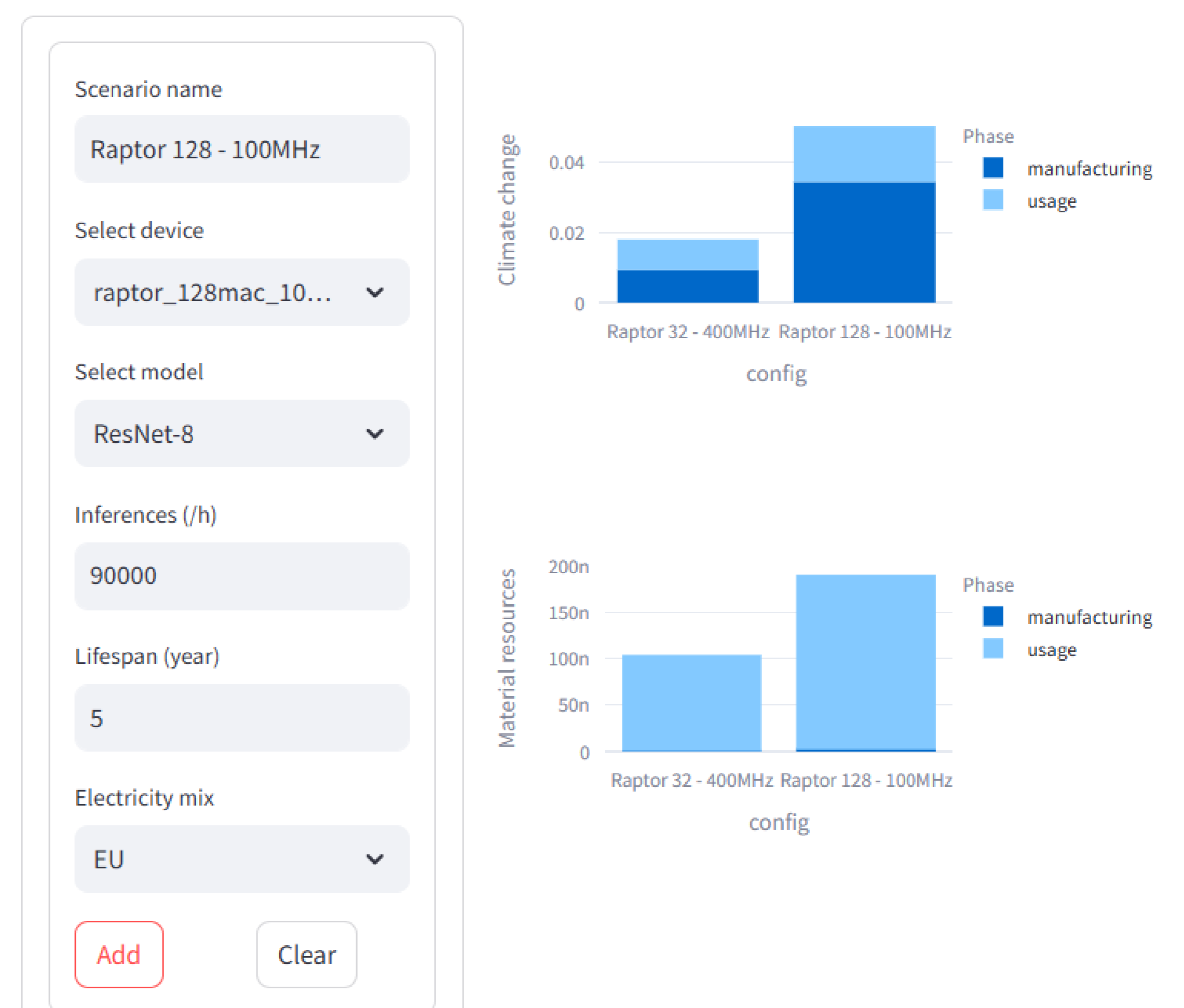


Figure 2: Aidage impact GUI interfaced with Appa Run, which uses AI accelerators impact models

