La Quête du Scheduling Parfait : Jouer sur Tous les Tableaux

Nicolas Tirel - Philippe Roose, Sergio Ilarri, Adel Noureddine, Olivier Le Goaër

UPPA, Anglet, France/UNIZAR, Saragosse, Espagne

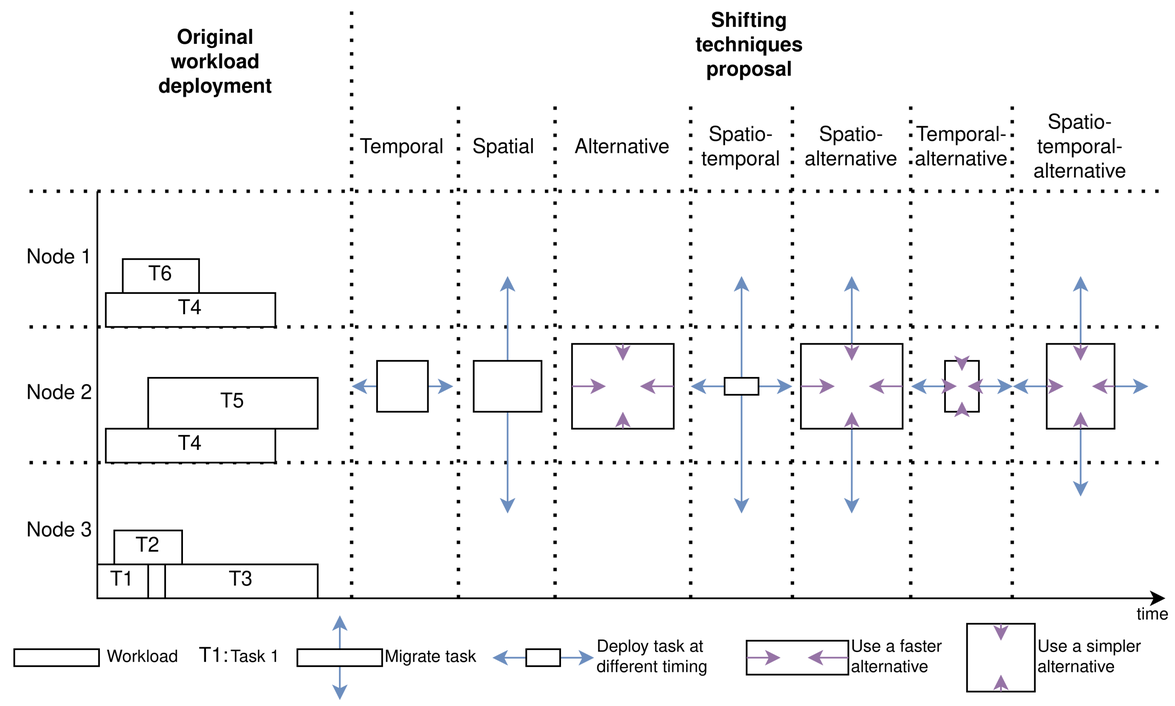
Context → Problem

- Halting the worsening climate change requires no more carbon emissions. → The impact of the ICT sector has never ceased to increase.
- The energy transition causes conflicts by increasing electricity needs. → Increased computing demand requires more power.
- Optimizing energy efficiency faces limits. → The solutions provided so far do not address the problem.

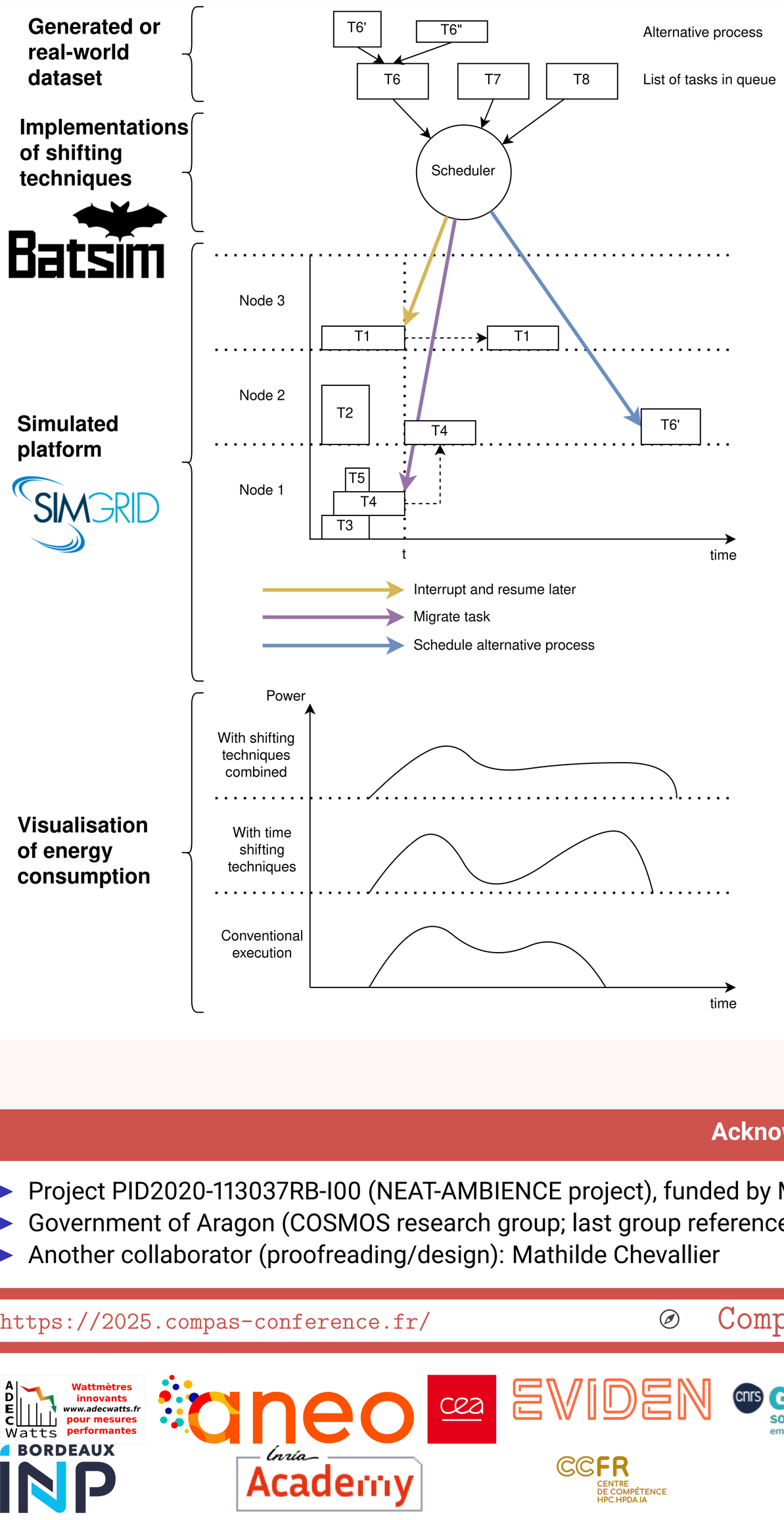
Motivation

- Shifting techniques have the potential to reduce both energy consumption and carbon emissions.
- Identify energy profiles by type of tasks using simulations.
- Provide this information to app/software designers.

Shifting techniques



Proposal



Early results

Table: Impact of shifting techniques in comparison with a conventional execution

Technique	Total energy consumed (joules)	Average power (Watts)	Total makespan (seconds)	Average task execution time (seconds)	Average/ max waiting time (seconds)
0. Conventional execution	9.74	207.44	0.17	0.05	0.00/0.0
1. Postponing task	9.74	204.80	0.26	0.05	0.05/0.1
2. Interrupting task	9.74	205.96	0.21	0.05	0.03/0.1
3. Migrating task	9.74	207.44	0.17	0.05	0.00/0.0
4. Alternative process	9.54	206.62	0.18	0.07	0.00/0.0
5. Migrating task with postponing	9.74	205.96	0.21	0.05	0.03/0.1
6. Postponing task with alternative process	9.54	204.41	0.28	0.07	0.05/0.1
7. Interrupting task resumed wit alternative process	9.54	205.89	0.21	0.07	0.03/0.1
8. Migrating task with alternative process	9.54	206.62	0.18	0.07	0.00/0.0
9. Postponing and migrating task with alternative process	9.54	205.89	0.21	0.07	0.03/0.1

The aim is to obtain energy gains while limiting impacts. The result is better than original in green, similar in yellow, and worse in red.

Limits → next work

- Energy overhead when migrating is not considered. → Implement more complex energy profiles.
- Only homogenous machines are used. → Implement heterogeneous machines with various energy profiles.
- The workload considered is simple. → Implement real-world dataset.
- Carbon impact is not considered yet. → Implement carbon intensity data.

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