ANR Datazero

DATAcenter with Zero Emission and RObust management using renewable energy

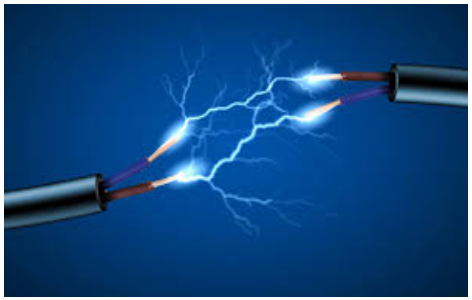
October 1st, 2015 — December 31st 2019

March 2020 - December 2023

datazero.org

as green as possible

Jean-Marc.Pierson@irit.fr



An innovative datacenter model

» Adapting the *IT load* to the Power available

and

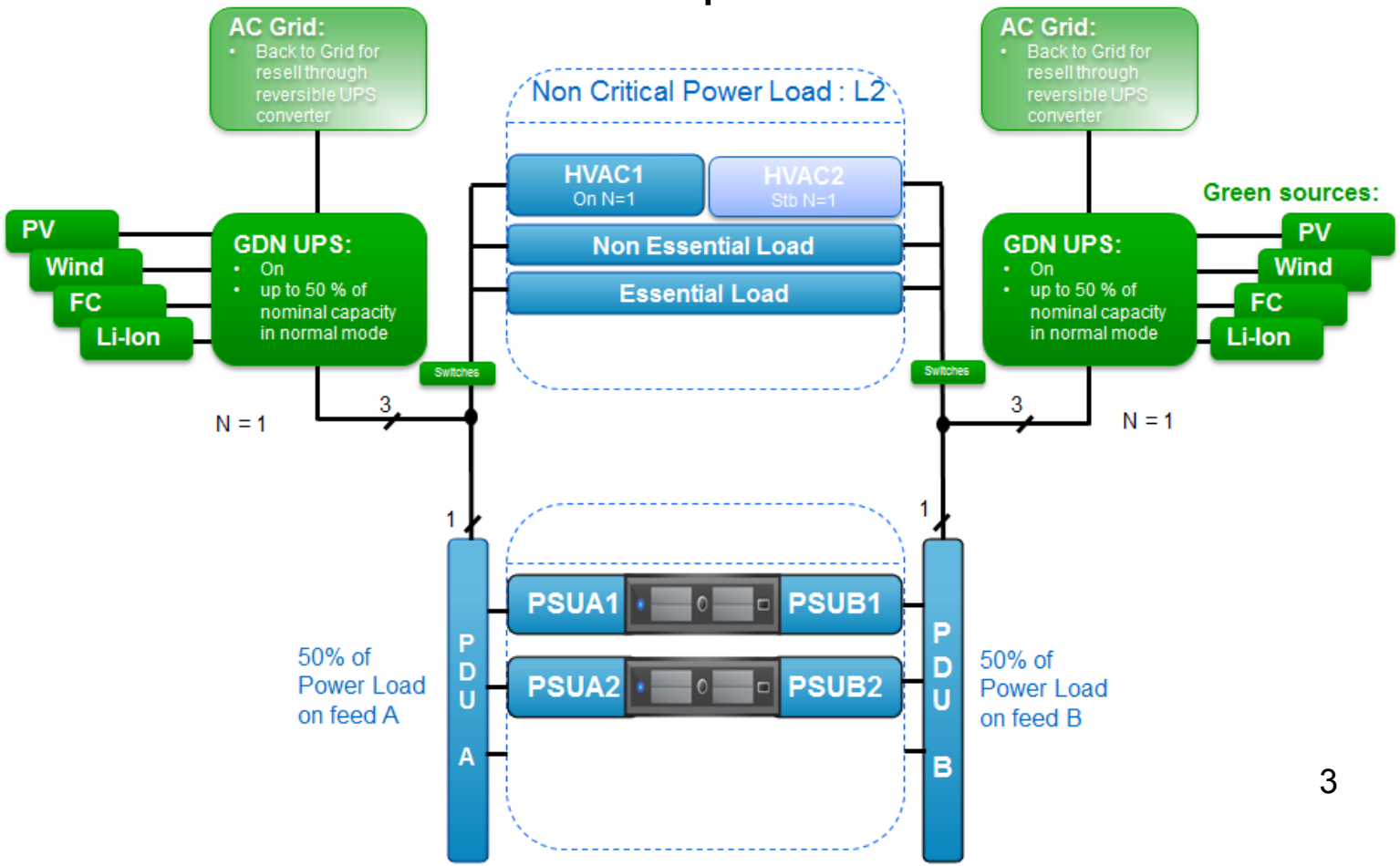
» Adapting the *Power* to the incoming IT load

while avoiding unnecessary operations and materials and using a mix of energy sources

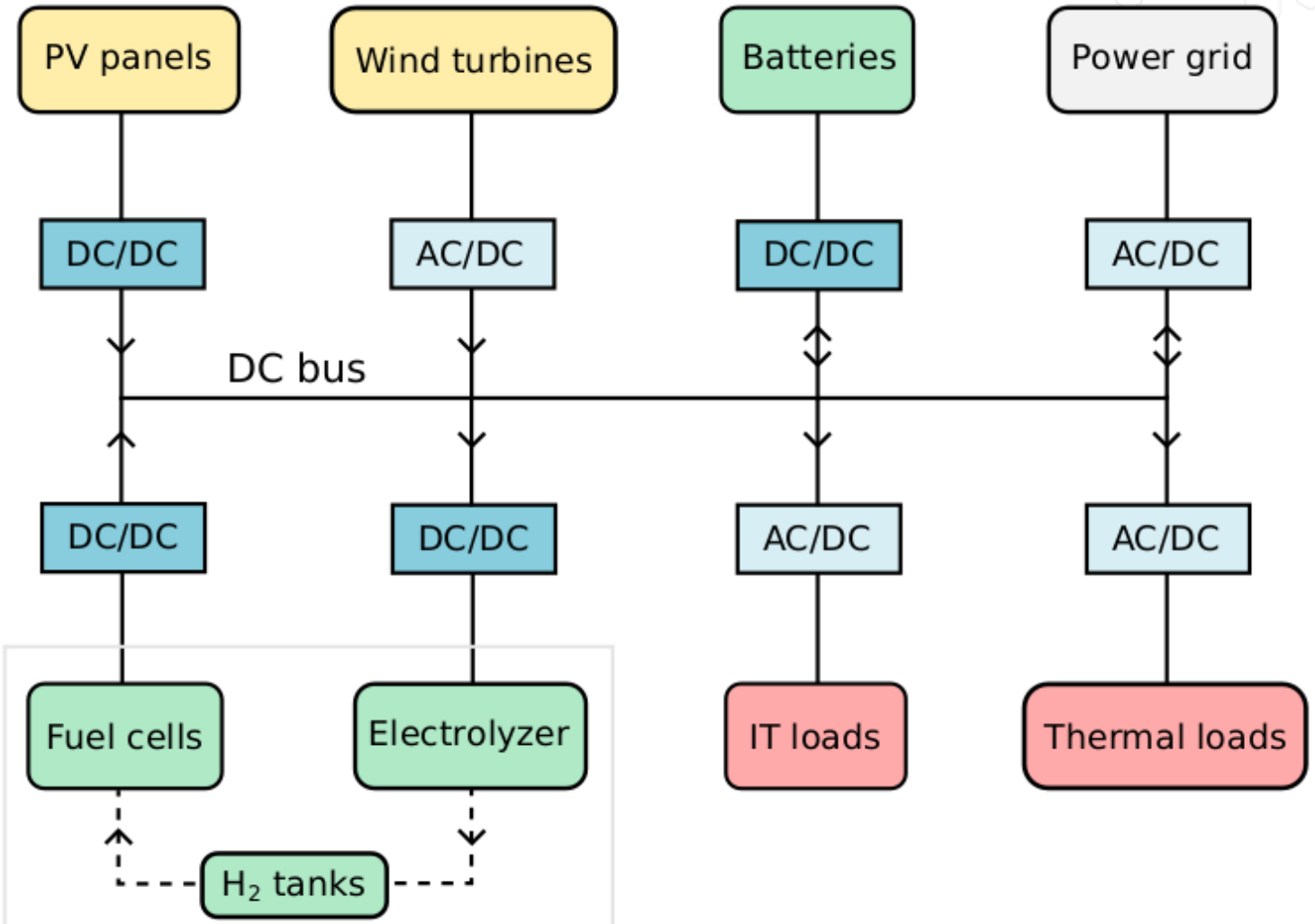
First, we need an electrical and IT connection…

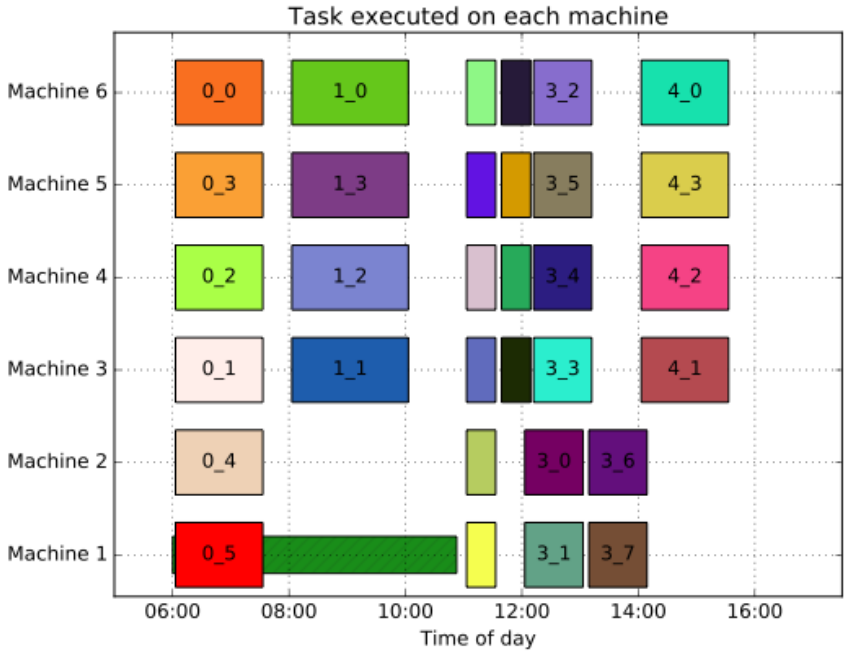
We proposed two infrastructures:

- "Classical" Electrical Schema: Up to N+1 (Green+Grid)
- Innovative Electrical Schema: Up to 2N Green

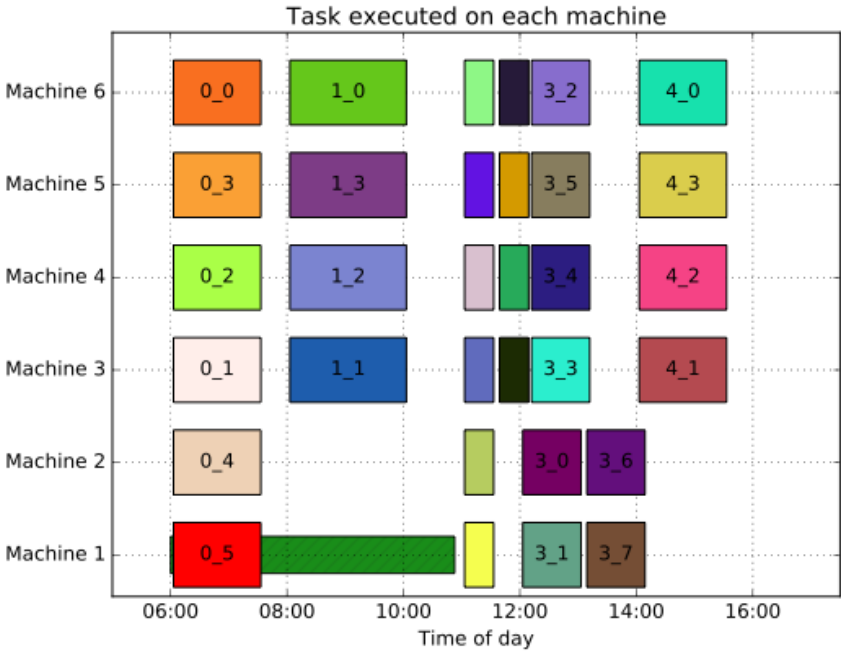


The components form a microgrid





A simplistic example


Task executed on each machine
Machine 6
Machine 5
Machine 4
Machine 3
Machine 2
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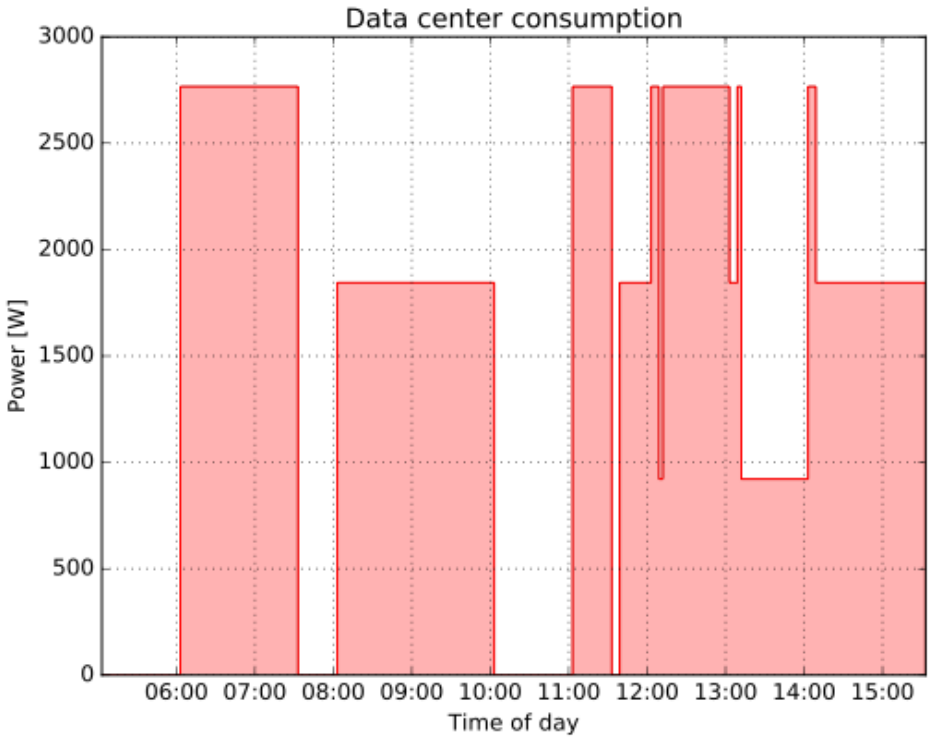
Data center consumption
Power [W]
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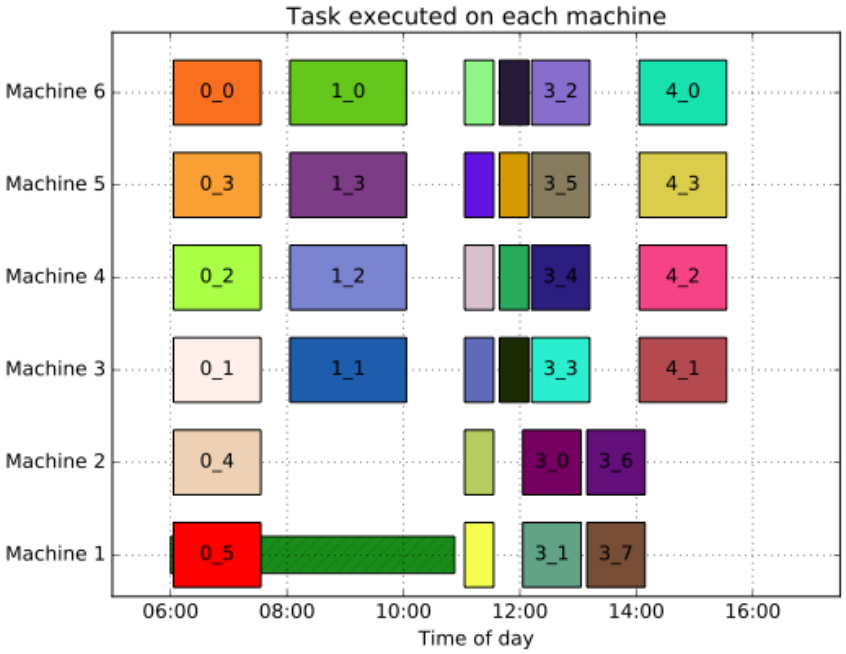
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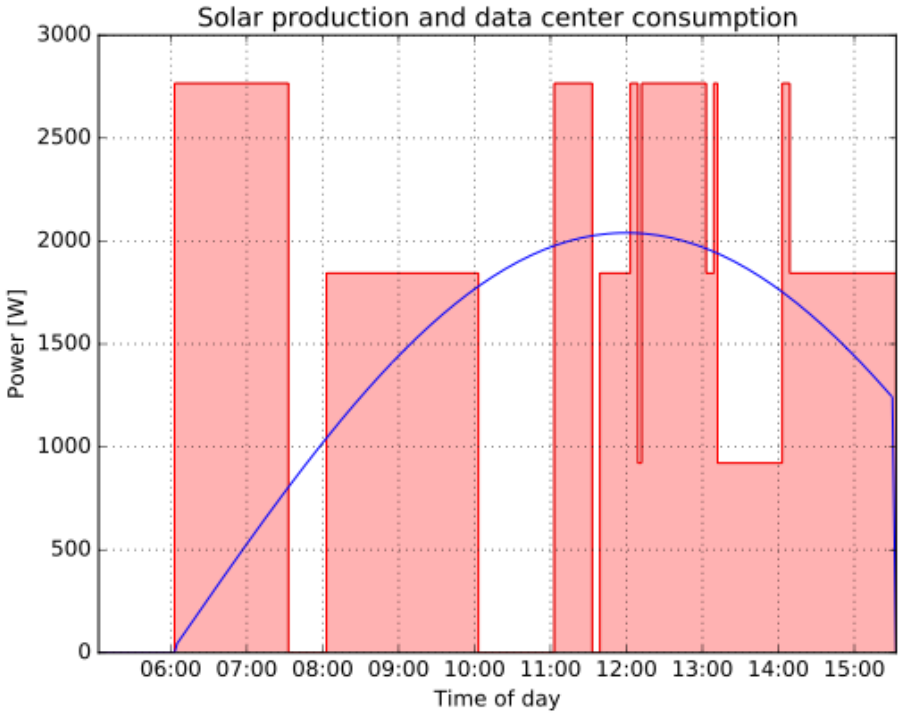
Solar production and data center consumption
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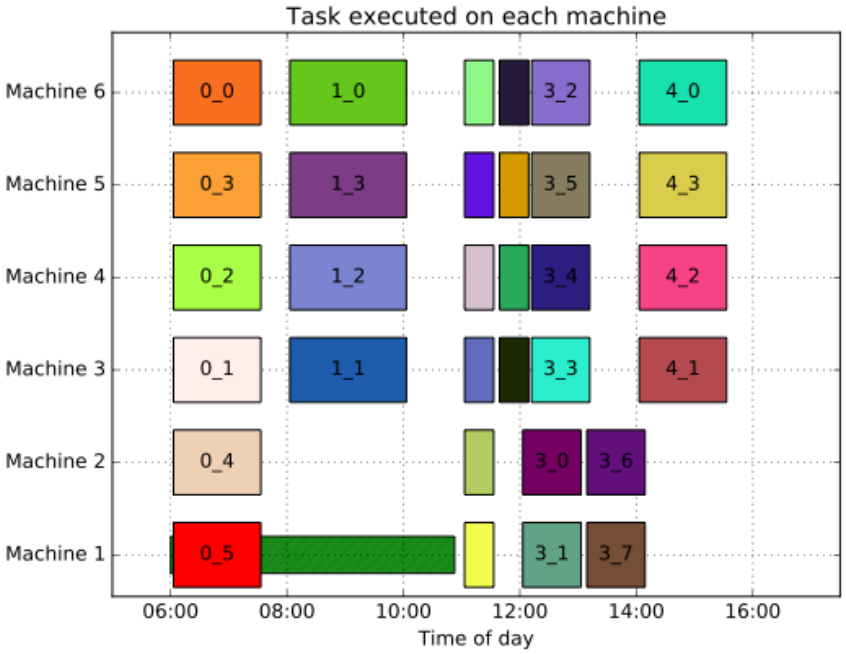
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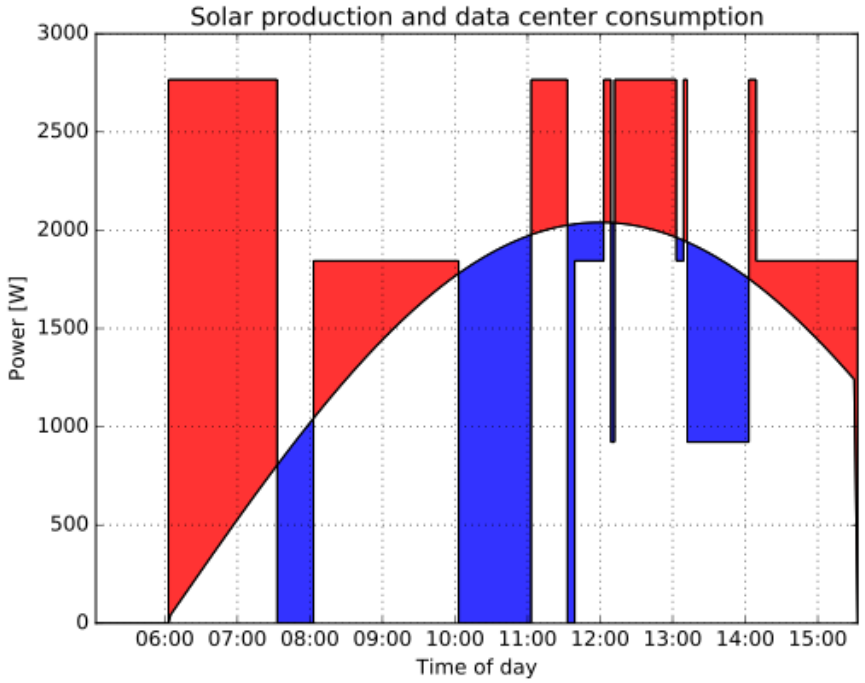
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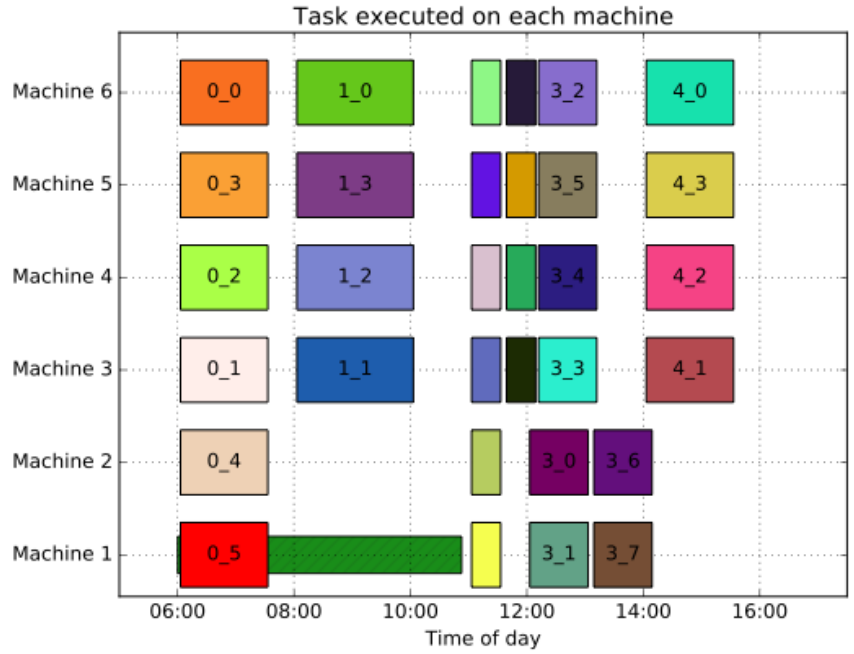
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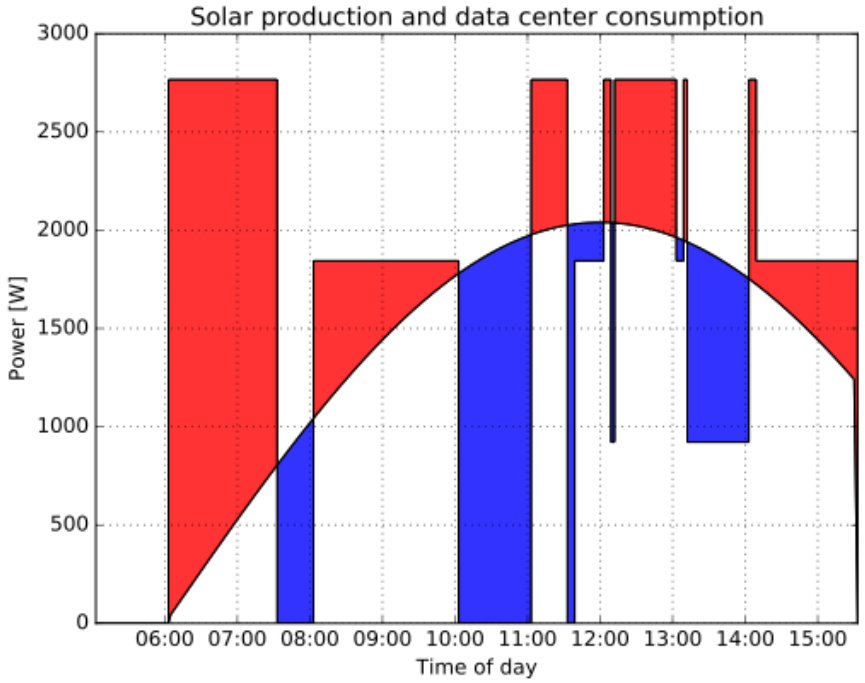
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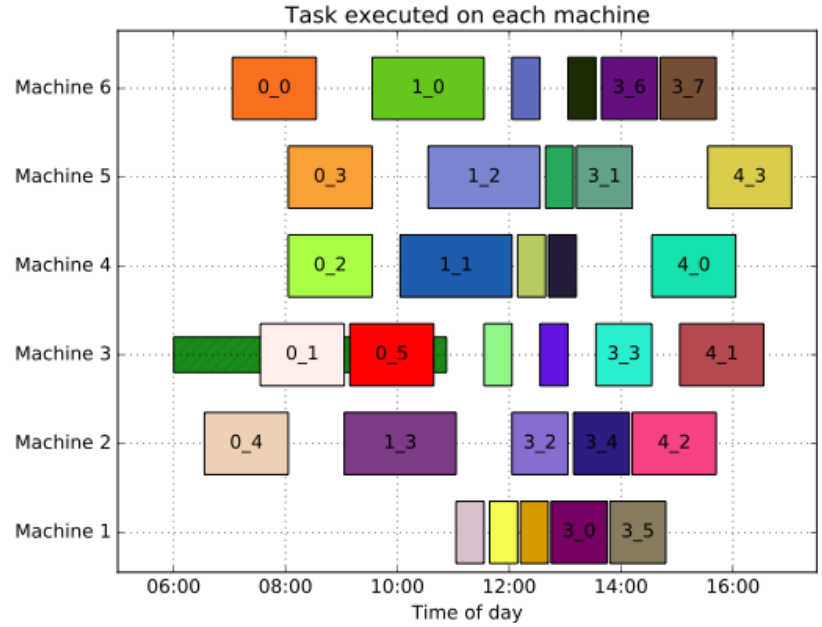
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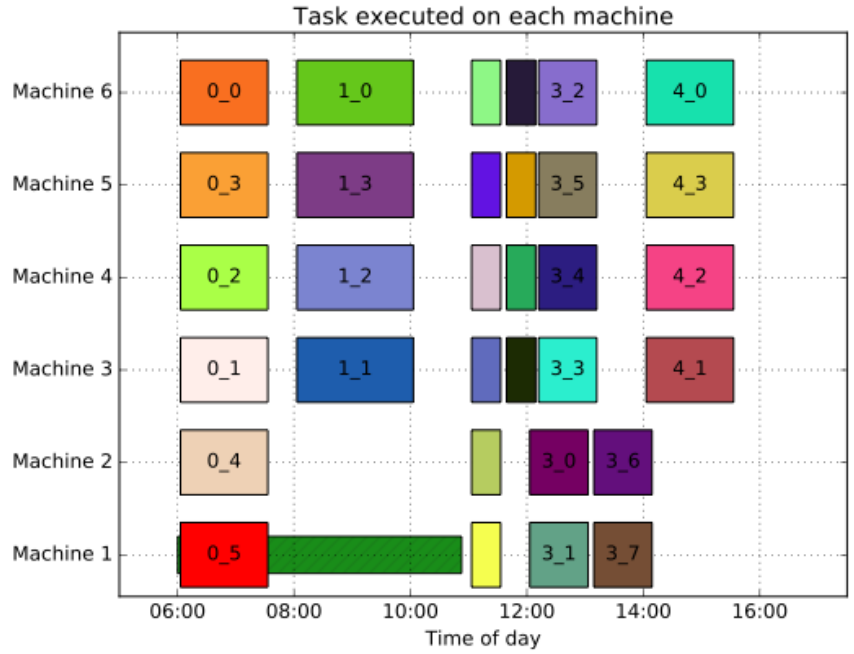
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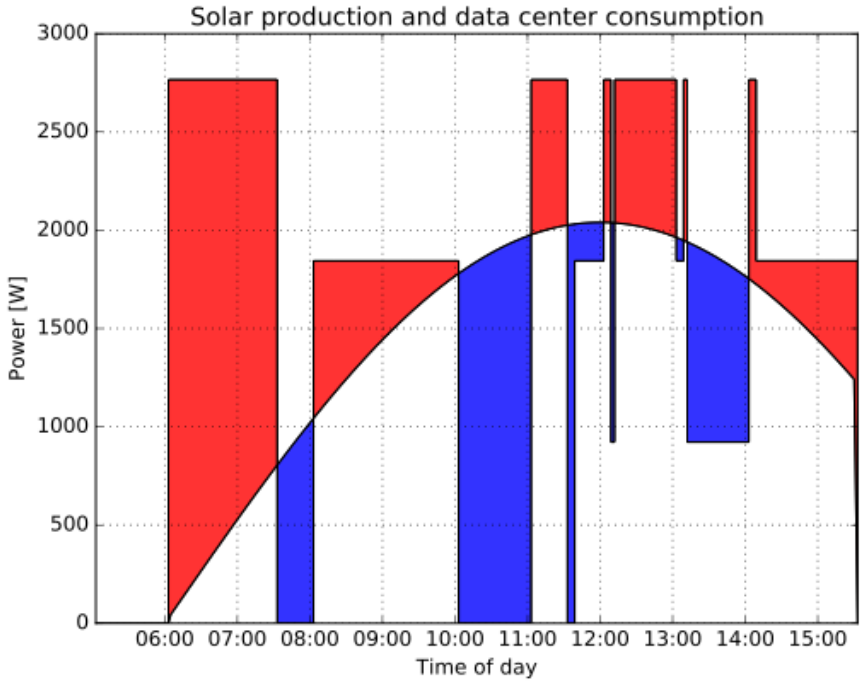
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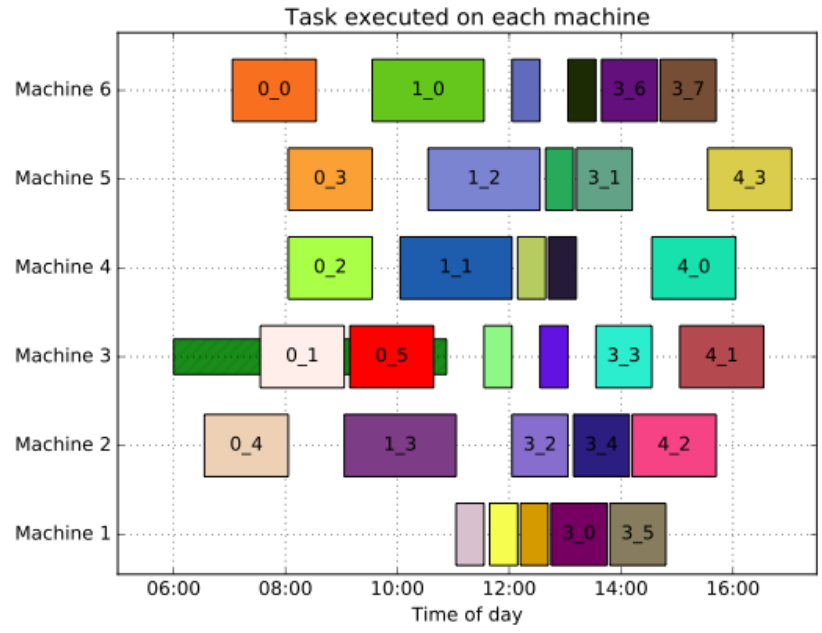
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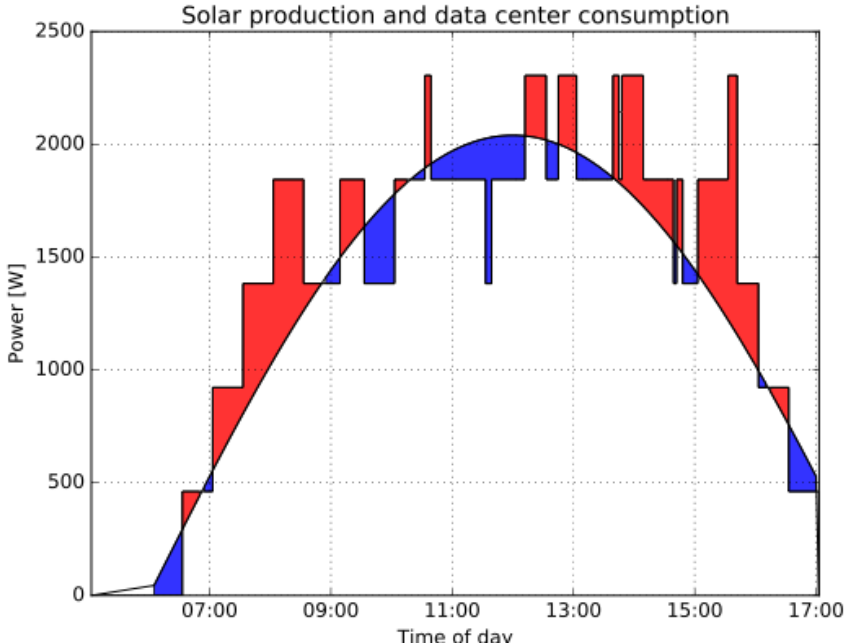
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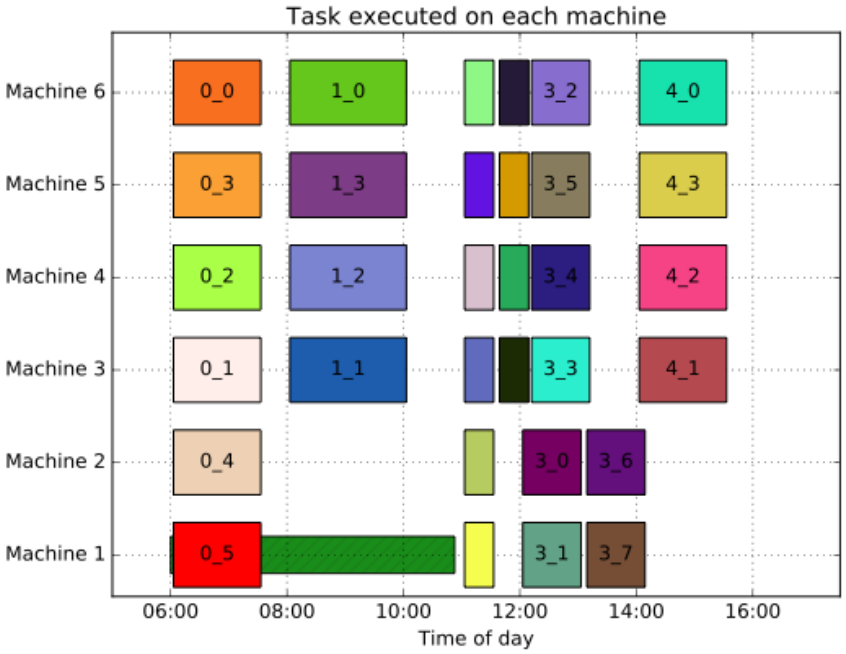
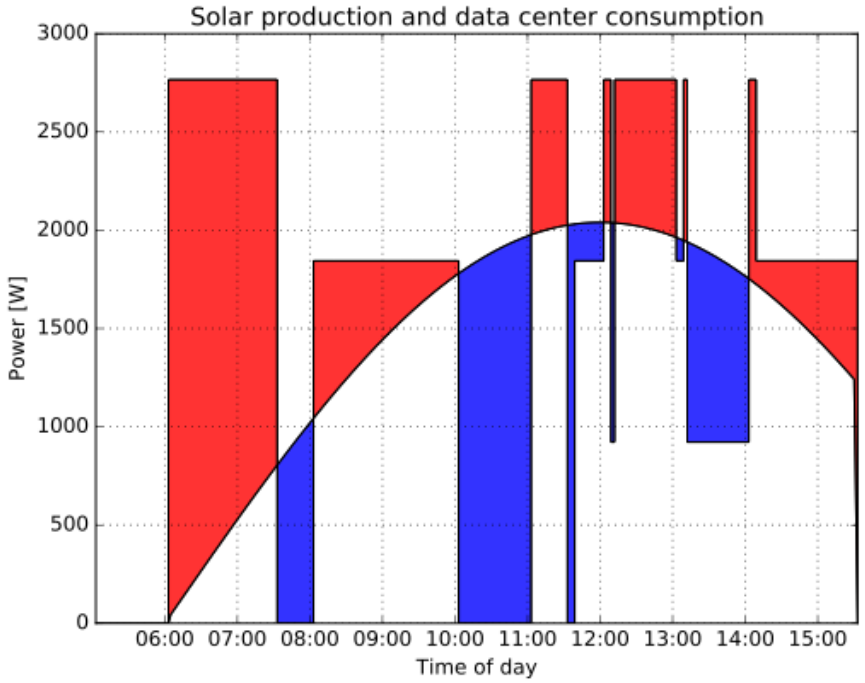
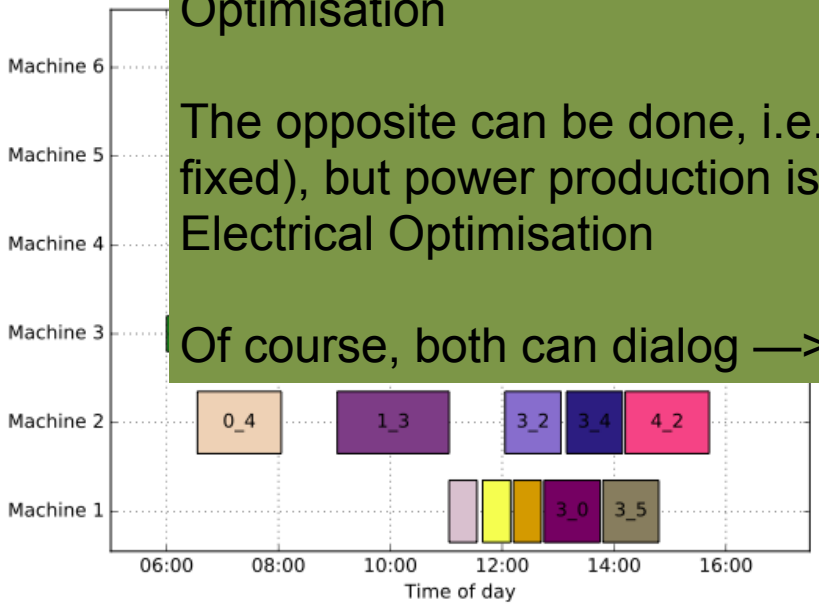


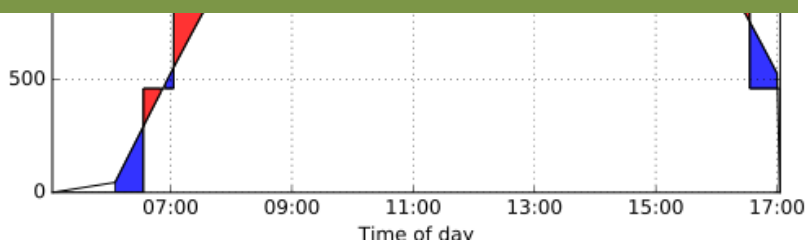


In this example, the IT Load is optimised for the power production —> IT Optimisation

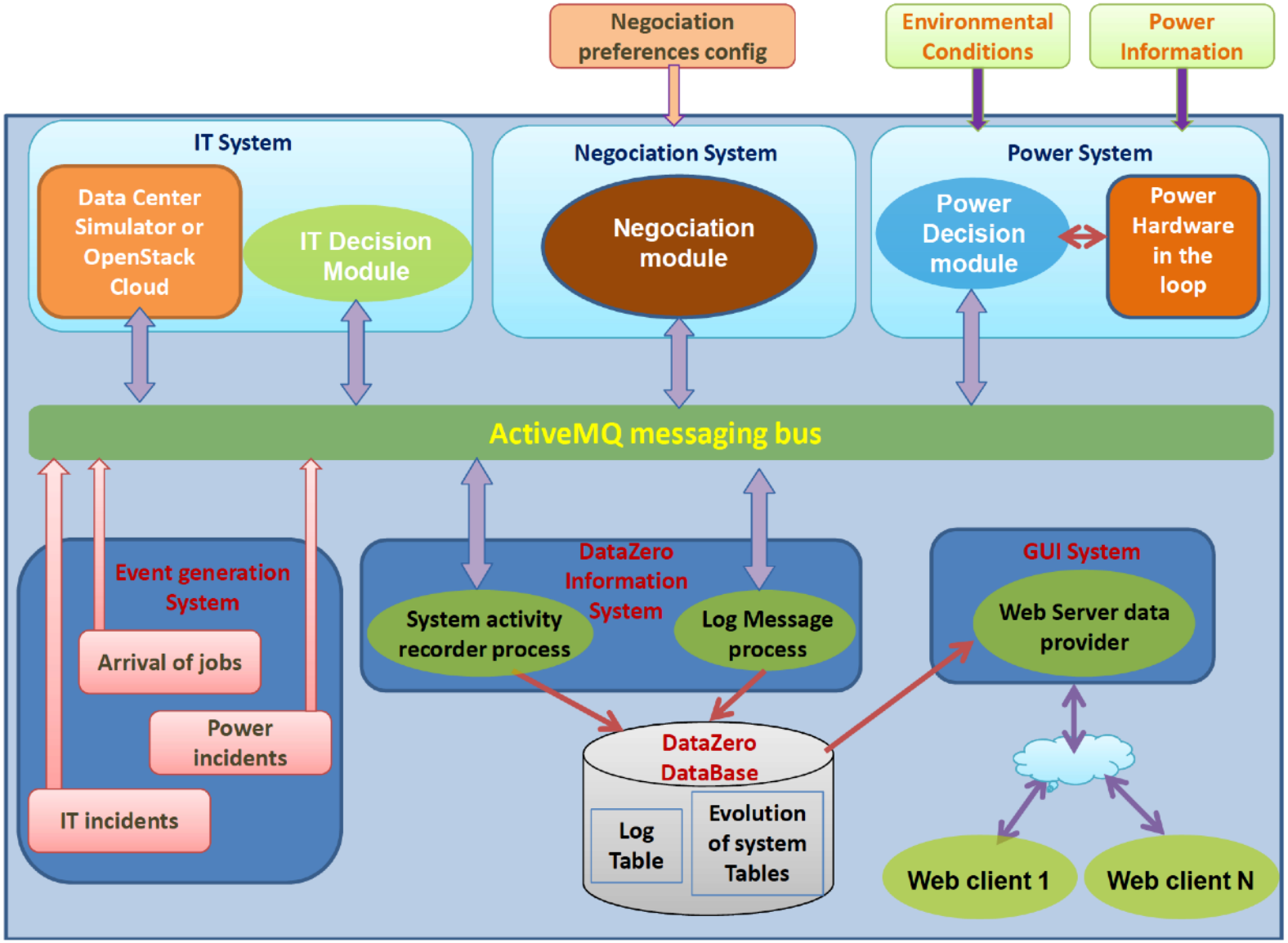
The opposite can be done, i.e. tasks are not moved (i.e. power demand is fixed), but power production is optimised with multiple electrical sources —> Electrical Optimisation

Of course, both can dialog —> Negotiation





Middleware, Simulation, Real Hardware



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Main results

- Sizing of datacenter powered by renewable datacenter (mathematical model)
- Simulation of the operation of datacenters with renewable energy
- Experiments with Openstack Cloud, real PV and FC

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Results

- All papers are available on datazero.org
- 15+ Research papers, and counting…

- Jean-Marc Pierson, Gwilerm Baudic and Stéphane Caux, Berk Celik, Georges Da Costa, Léo Grange, Marwa Haddad, Jérôme Lecuivre, Jean-Marc Nicod, Laurent Philippe, Veronika Rehn-Sonigo, Robin Roche, Gustavo Rostirolla, Amal Sayah, Patricia Stolf, Thi Minh-Thuyen and Christophe Varnier, DATAZERO: **Datacenter With Zero Emission and Robust Management Using Renewable Energy**, in IEEE Access journal, Volume 7, pages 103209 - 103230, July 2019, https://doi.org/10.1109/ACCESS.2019.2930368

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Next Steps : DATAZERO 2

- Same consortium, until end 2023/2024
- More importance on robustness of the task scheduling and power source commitment against uncertainty and failure.
- Dynamic reconfiguration of electrical connection
- Higher TRL
- Construction of an Advisory Board

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PROJET FINANCÉ PAR L'ANR - PROJECT FUNDED BY THE ANR
ANR

Questions?

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IRIT CNRS - INPT - UPS - UT1 - UT2J
EATON Powering Business Worldwide
Université de Toulouse INP TOULOUSE Laplace
UBFC UNIVERSITÉ BOURGOGNE FRANCHE-COMTÉ femto-st SCIENCES & TECHNOLOGIES