



CNRS - INP - UT3 - UT1 - UT2J

Institut de Recherche en Informatique de Toulouse



Numérique Eco-Responsable

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Séminaire Humanités Numériques

8 Décembre 2023





About me



- Now: PhD thesis at **SEPIA** team **IRIT** (Toulouse)
 - Supervisors: **Georges DA COSTA** and **Jean-Marc PIERSON**

sept
16

sept
19

sept
20

apr
21

Ingénieur polytechnicien



INSTITUT
POLYTECHNIQUE
DE PARIS

Double degree



Master thesis



PhD

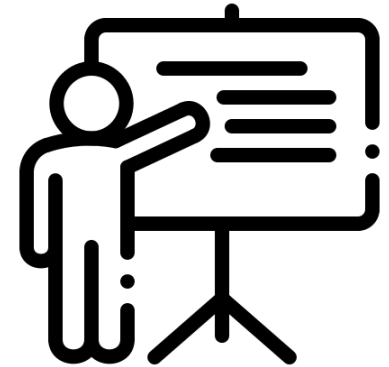


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en Informatique de Toulouse

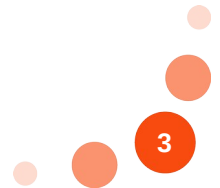


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Environmentally-aware users in data centers



www.flaticon.com/authors/alkhalifi-design





General introduction

Green IT & IT for Green

What happens behind a web page?



The screenshot shows the homepage of the University of Toulouse Jean Jaurès. The header includes navigation links for ENT, ANNUAIRE, BIBLIOTHÈQUES, WEBMEDIA, and language options (FR, EN, ES, OC). A search bar is also present. Below the header, there are links for UNIVERSITÉ, FORMATION INSERTION, RECHERCHE, INTERNATIONAL, and VIE DES CAMPUS. Social media icons for Facebook, Twitter, LinkedIn, and Instagram are displayed. The main content area features a large image of a prehistoric skull being cleaned with a brush, accompanied by the text "Voyage en préhistoire, podcast On'R' #5". Below this, a paragraph describes the podcast as an opportunity for a journey in archaeology, focusing on the traces of Homo sapiens and humanity, with François Bon. A cookie consent banner is visible at the bottom, with buttons for "TOUT ACCEPTER", "PERSONNALISER", and "TOUT REFUSER".

<https://www.univ-tlse2.fr/>

Résultat pour www.univ-tlse2.fr

D

Hum, pas top.

Score : 47 / 100

Que veut dire mon score ▼

La bonne nouvelle, c'est que vous pouvez faire beaucoup mieux !



Classement de la page :

99708 / 188685

■ Trop lourde

3.163 Mo

■ Trop complexe

763 éléments

■ Trop de requêtes

47 requêtes

Two main paradigms

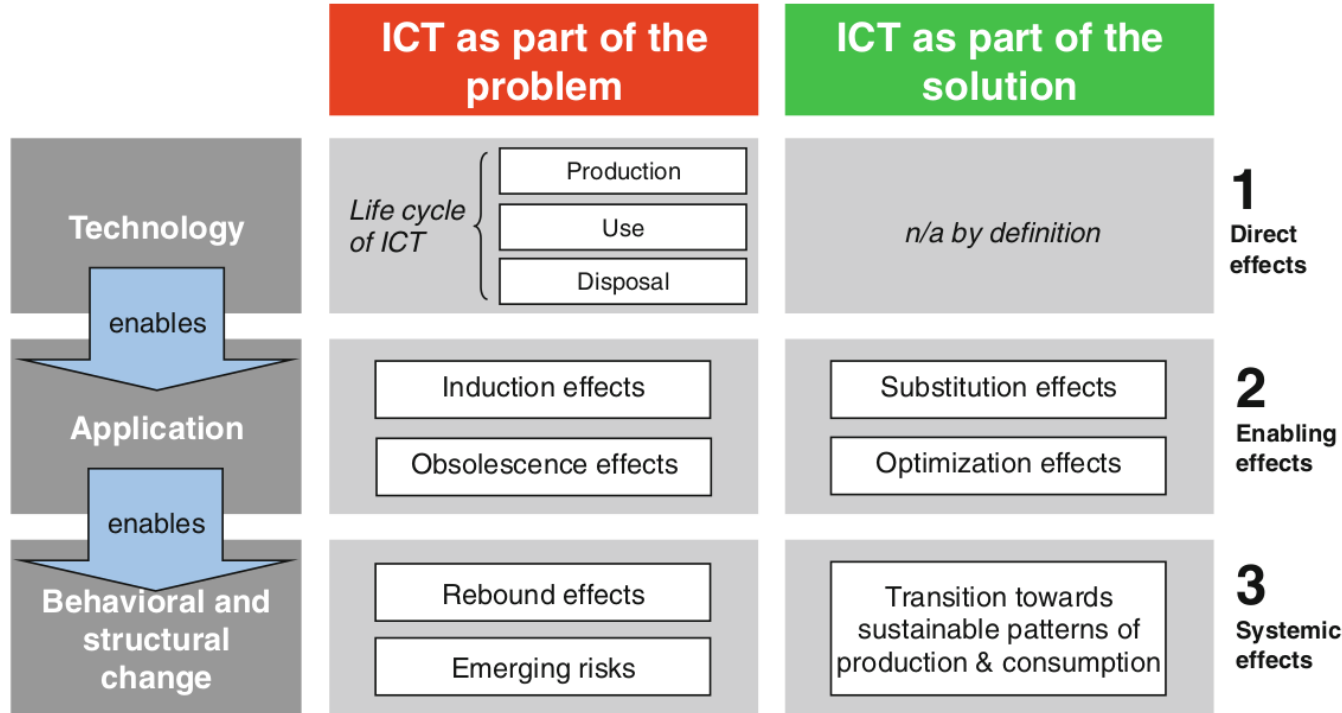
Green IT



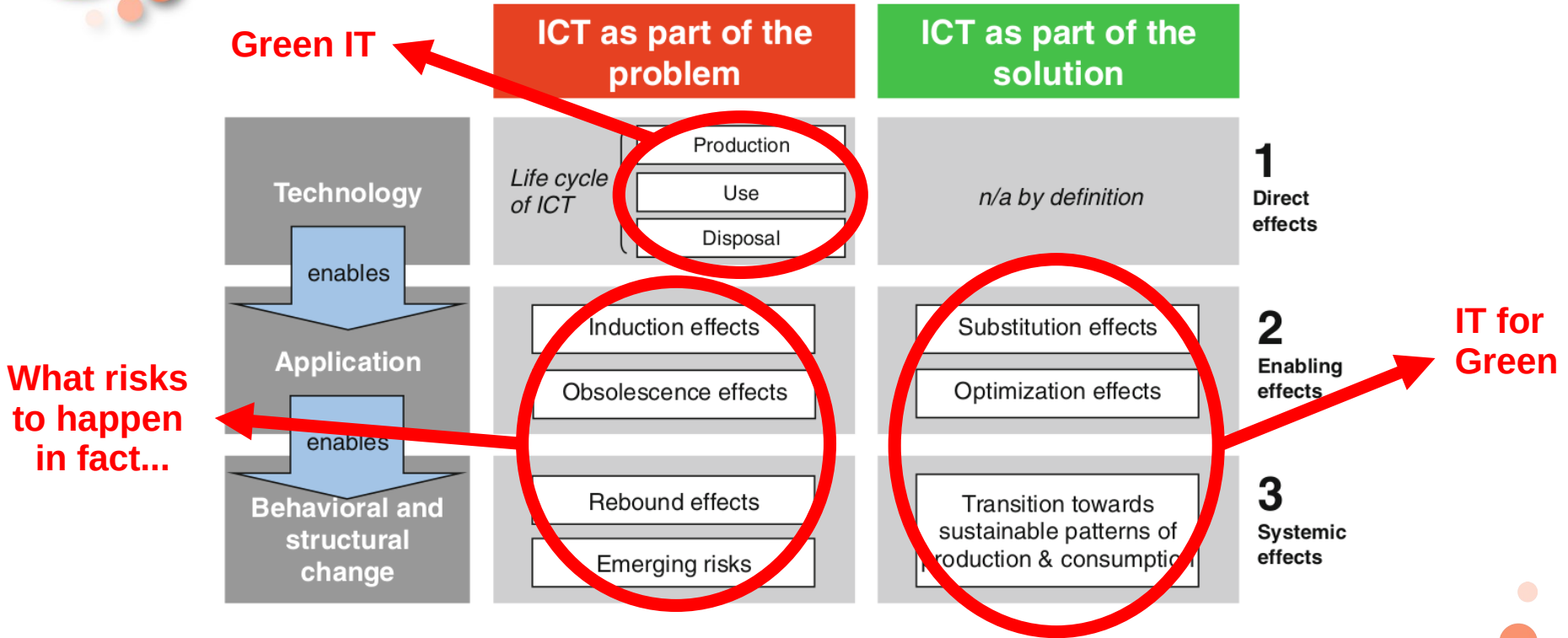
IT for Green



Framework to think about ICT & sustainability



Framework to think about ICT & sustainability



Hilty, L.M., Aebischer, B., 2015. *Ict for sustainability: An emerging research field*, in: ICT Innovations for Sustainability. Springer, pp. 3–36.

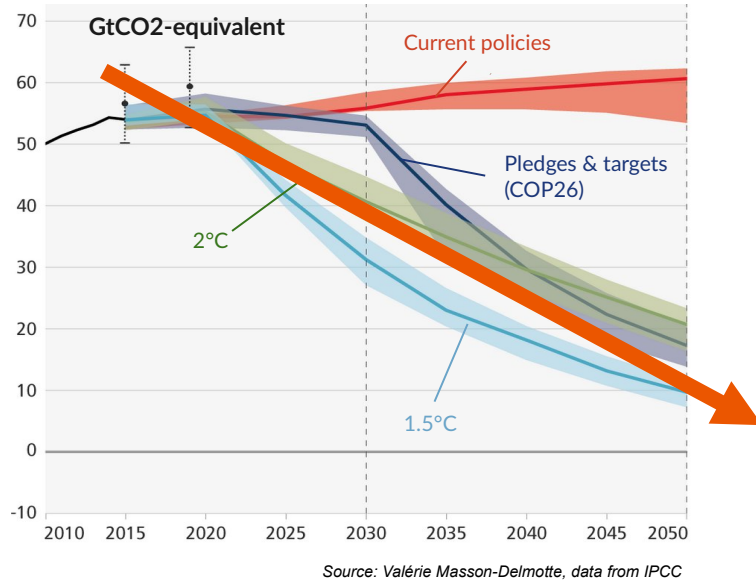


Green IT

Environmental impact of new technologies

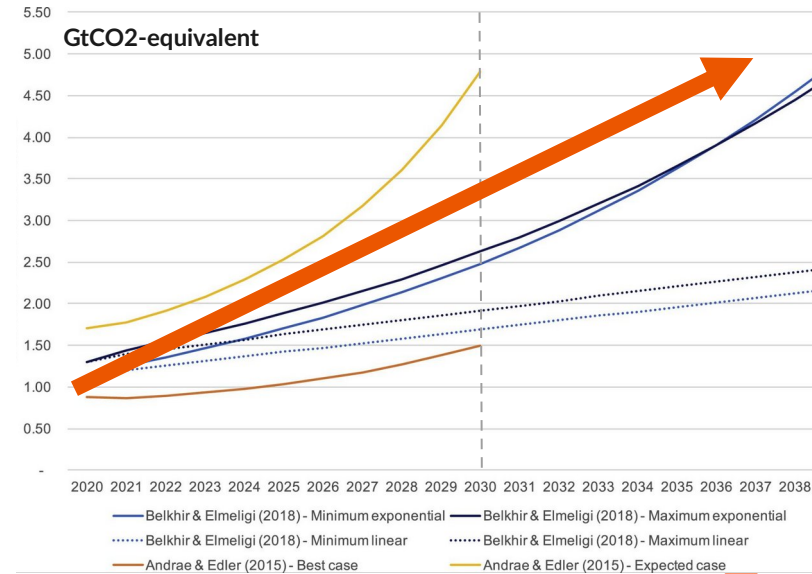
Growing GHG emissions

What we need to do:

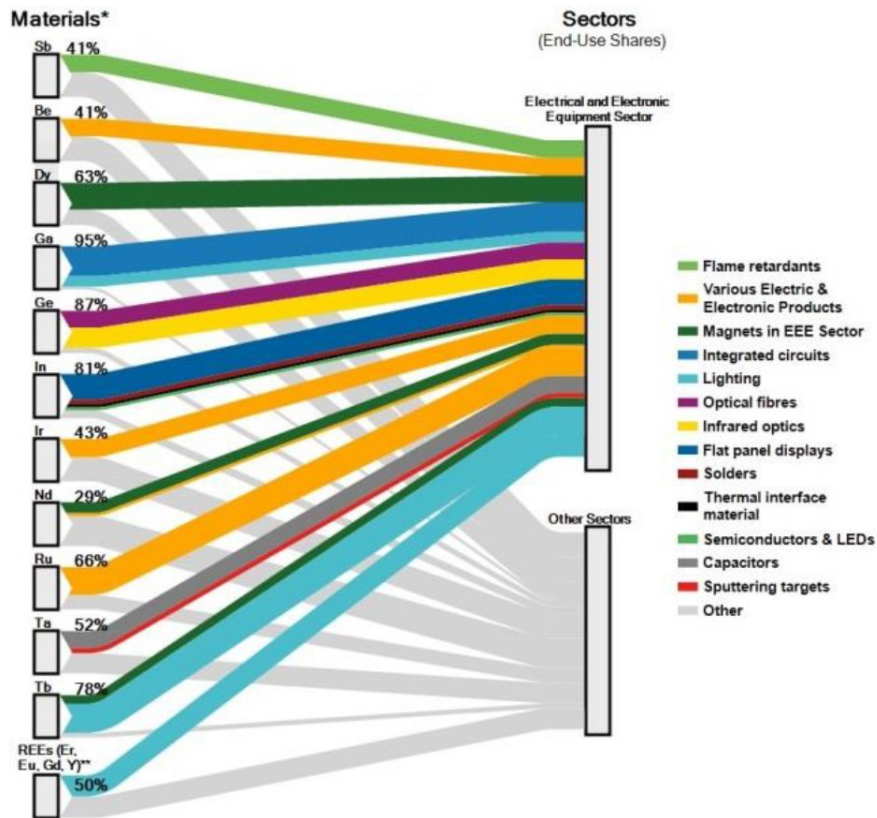


VS

**ICT industry =
2-4% global GHG emissions**



Other env. impacts



Source: <https://publications.jrc.ec.europa.eu/repository/handle/JRC108710>

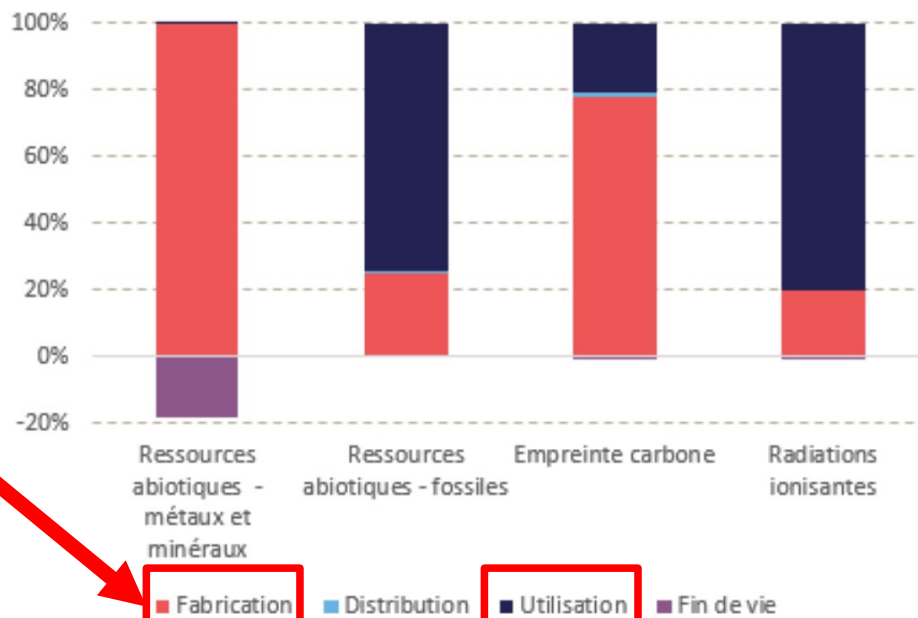
Life cycle assessment



Life cycle assessment



Environmental impact of ICT in France, distribution by life cycle phase



Source: [ADEME](#) and [ARCEP](#) 2022



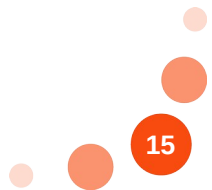
Reduce this impact?

80% GHG emissions come from **manufacturing phase:**

- Buy less
- Share
- Repair
- Make it last
- ...

The rest from the **use phase:**

- Use less
- Energy efficiency
- Minimalist designs
- ...

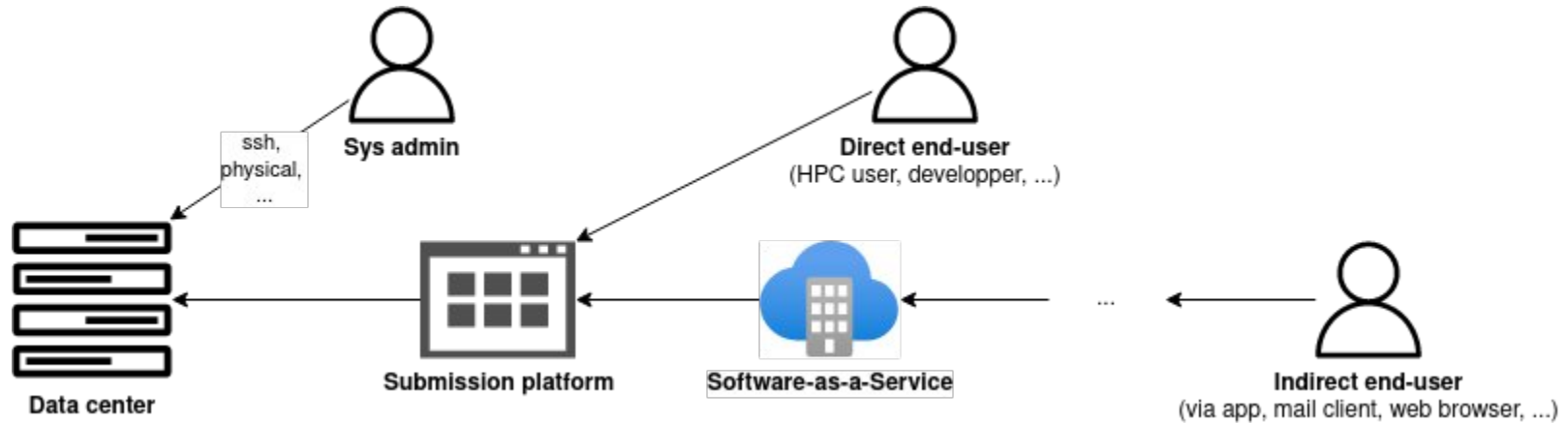




My PhD

Digital Sufficiency in data centers

Users of a data center



Simulation work

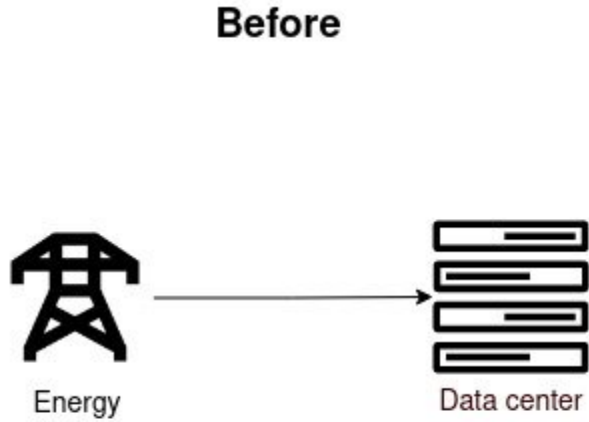
Before



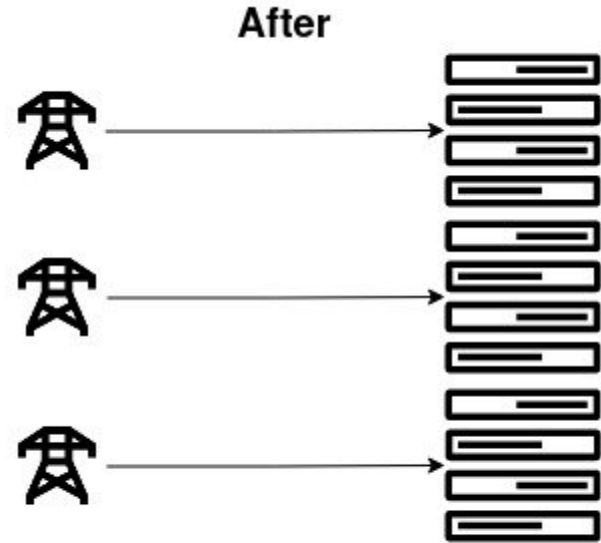
After



Rebound effect?

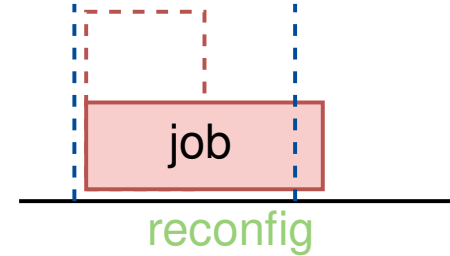
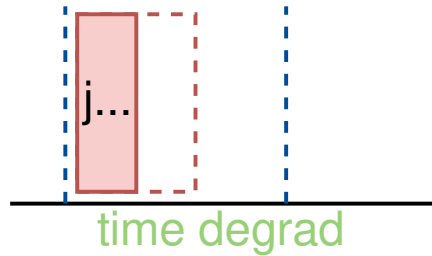
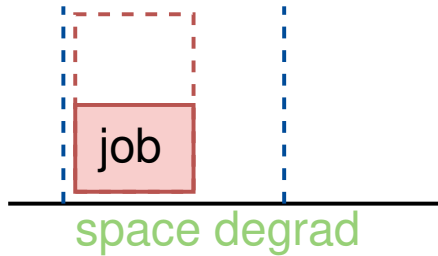
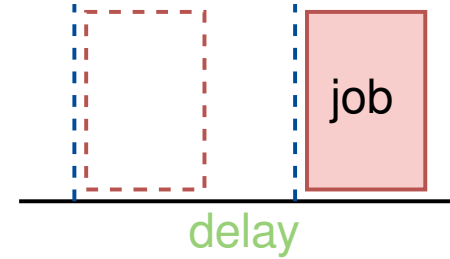
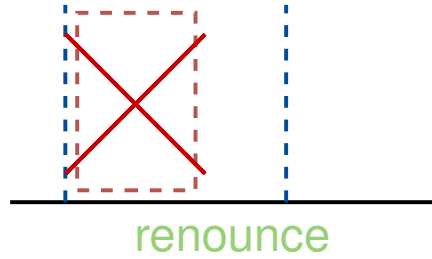
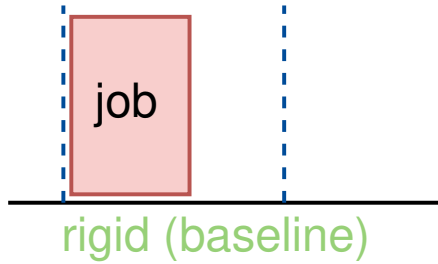


Data center = 1
Energy = 2



Data center = 3
Energy = 3

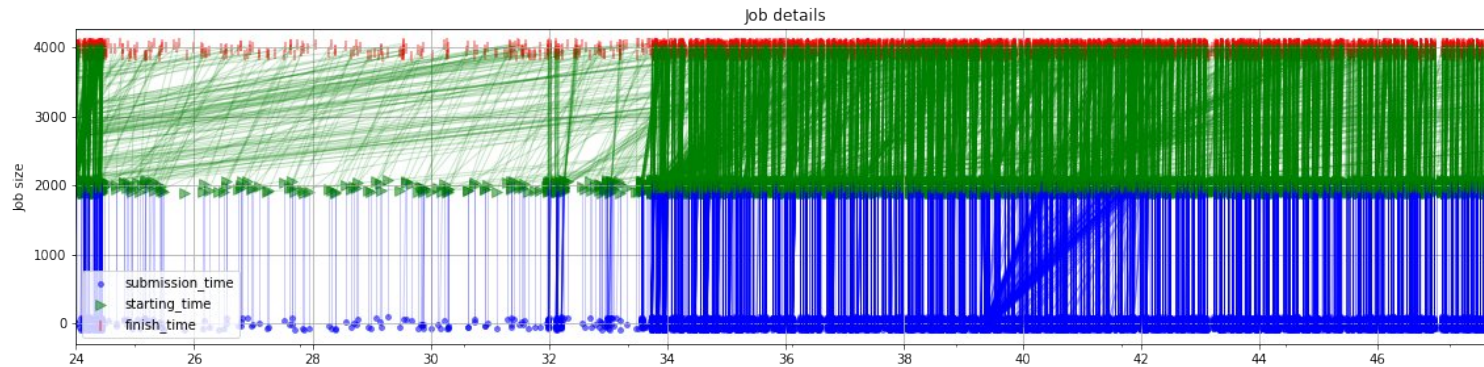
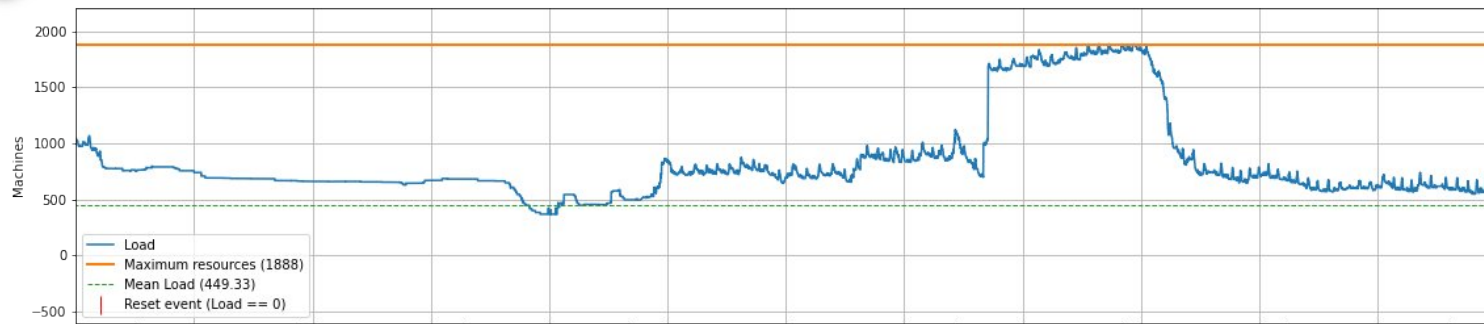
Submission behaviors





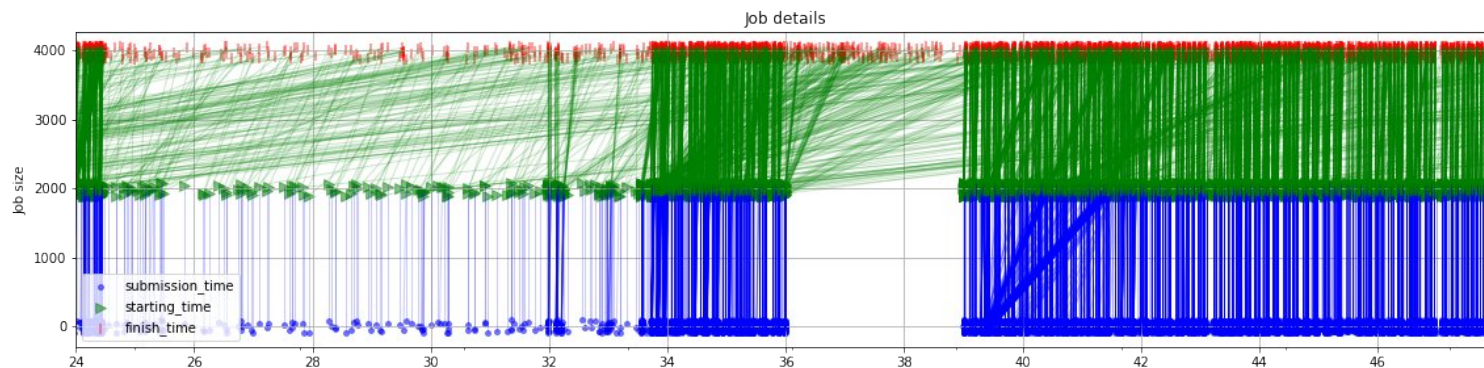
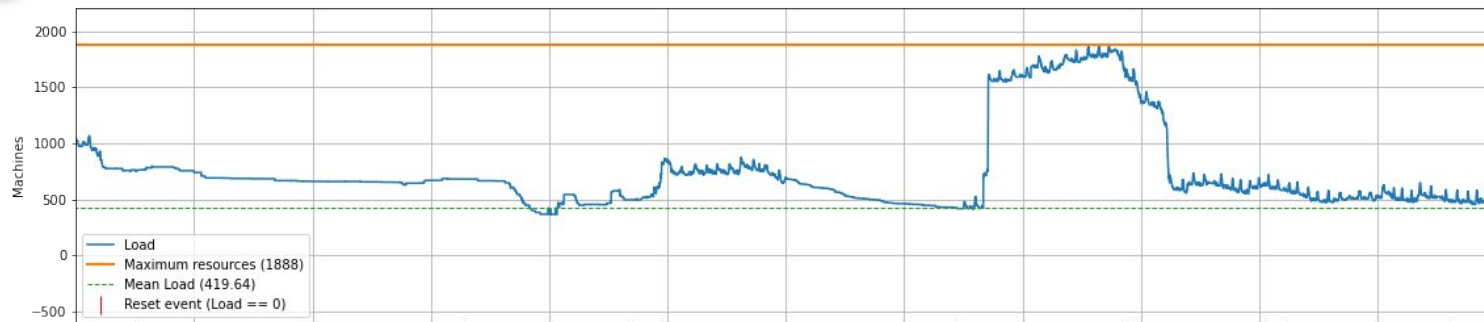
Rigid

../out/demand_response/ReplayRigid_may1_2_3



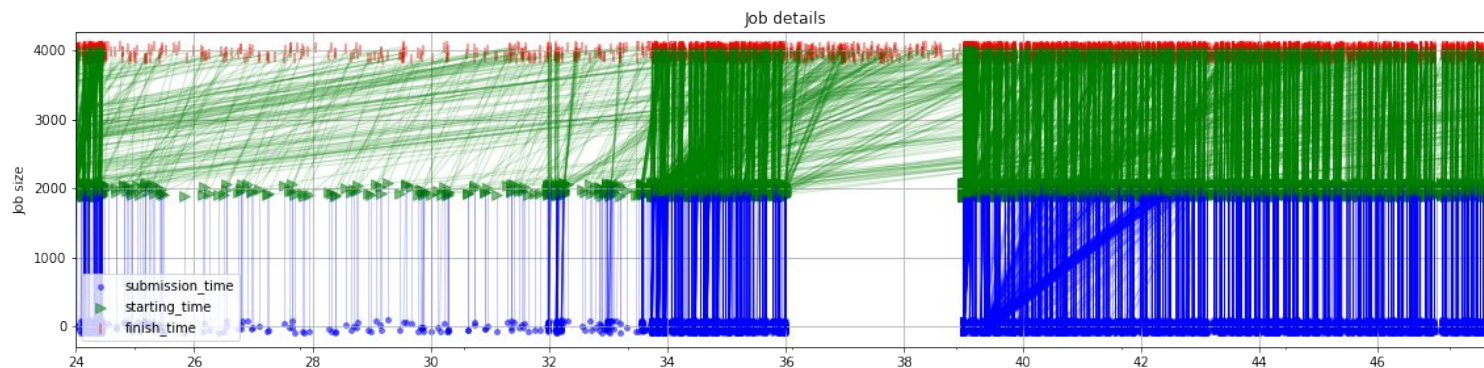
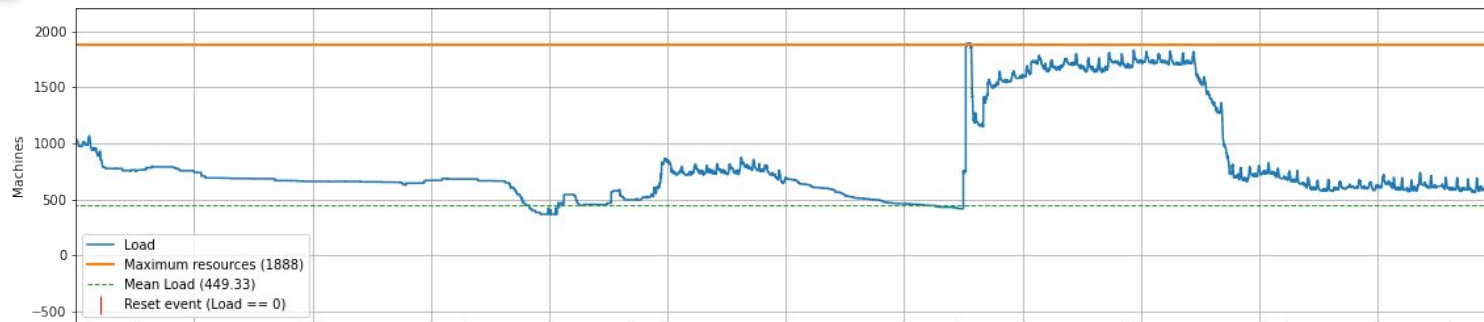
Renounce

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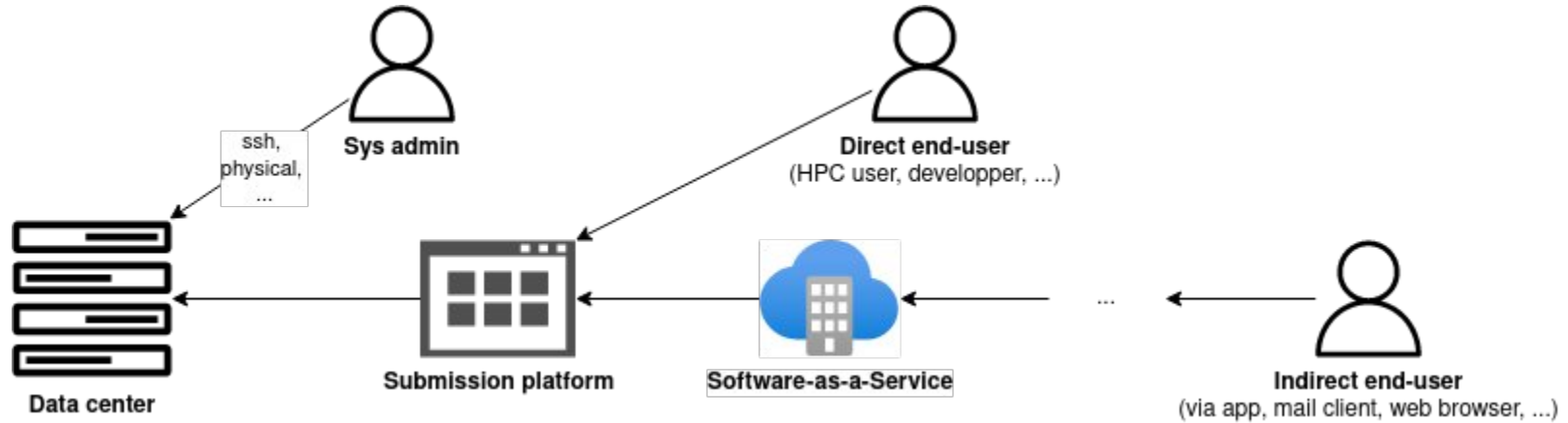


Delay

../out/demand_response/DMDelay_may1_2_3



Users of a data center





Digital *sufficiency* at work

- **Study goal:** Re-design the use of cloud services for flexible working towards sufficiency
- How much digital interventions are *necessary* and how much is *superfluous*?
- **Method:** Focus groups within companies

What is “flexible work” for you?

Describe the organisation of your working week



work-life balance



working hours



work locations

For each cloud-based daily task

Could you do without?

- If yes, how?
- If no, why?

Questions for **you** now

- How many digital devices do you own?
- How much time do you spend on the internet every day?
- Do you think that technology will save us?
- What is a *sufficient* computer / data center / smartphone app / ... ?





Conclusion

- New technologies have a **growing environmental impact**
 - 2-4% global GHG emissions
 - 80% in the **manufacturing phase** (in France)
- Need to rethink our **needs** for new technologies
 - Digital *sufficiency* (“sobriété numérique”)





Thank you for your attention!

- **Any questions?**
- **Contact me**
 - www.irit.fr/~Mael.Madon
 - mael.madon@irit.fr

