CNRS - INP - UT3 - UT1 - UT2J

Institut de Recherche en Informatique de Toulouse

Involving the users to mitigate the environmental impact of data centers

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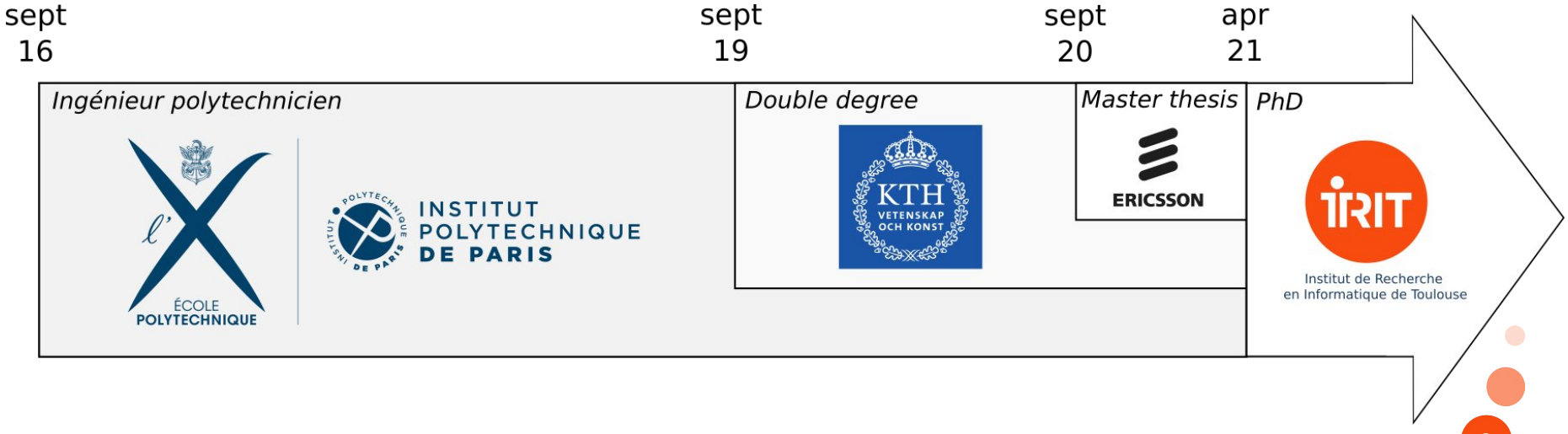
Talk @SummerSchoolEIT

July 4, 2023

About me

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



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www.flaticon.com/authors/alkhalifi-design

General introduction

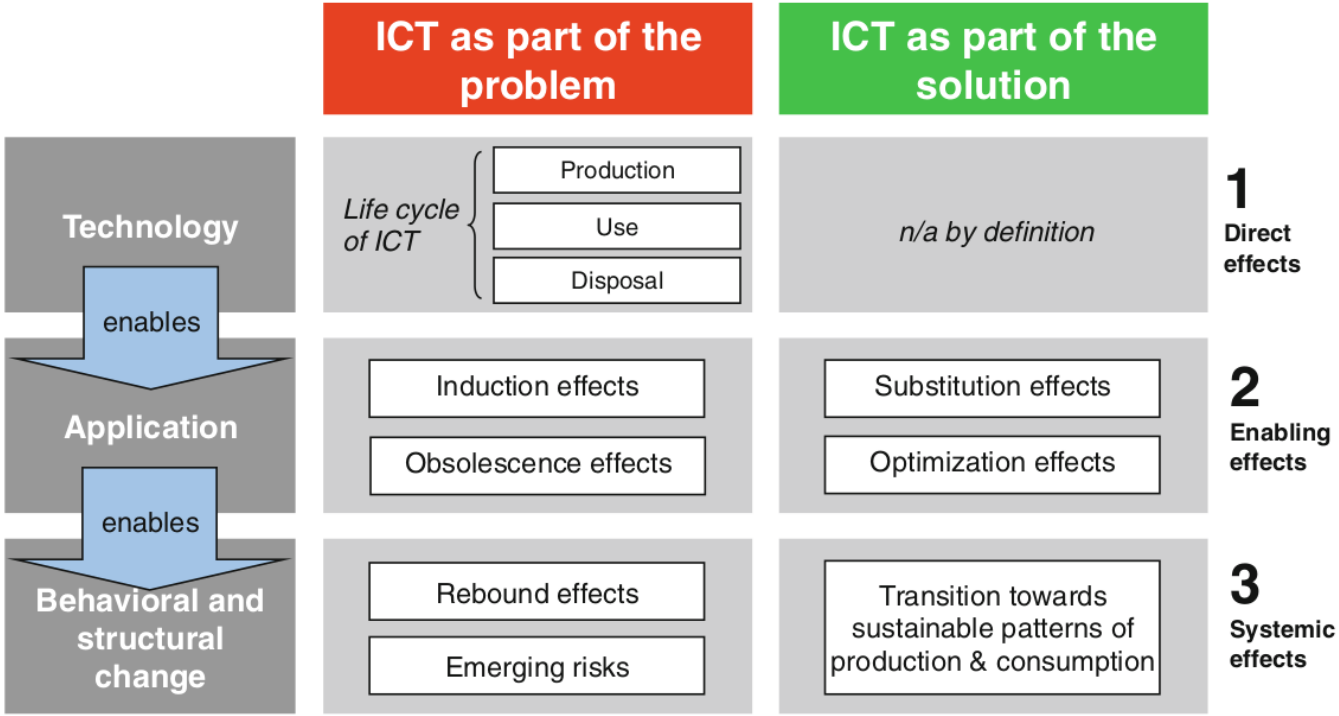
Green IT & IT for Green

Two main paradigms

Green IT

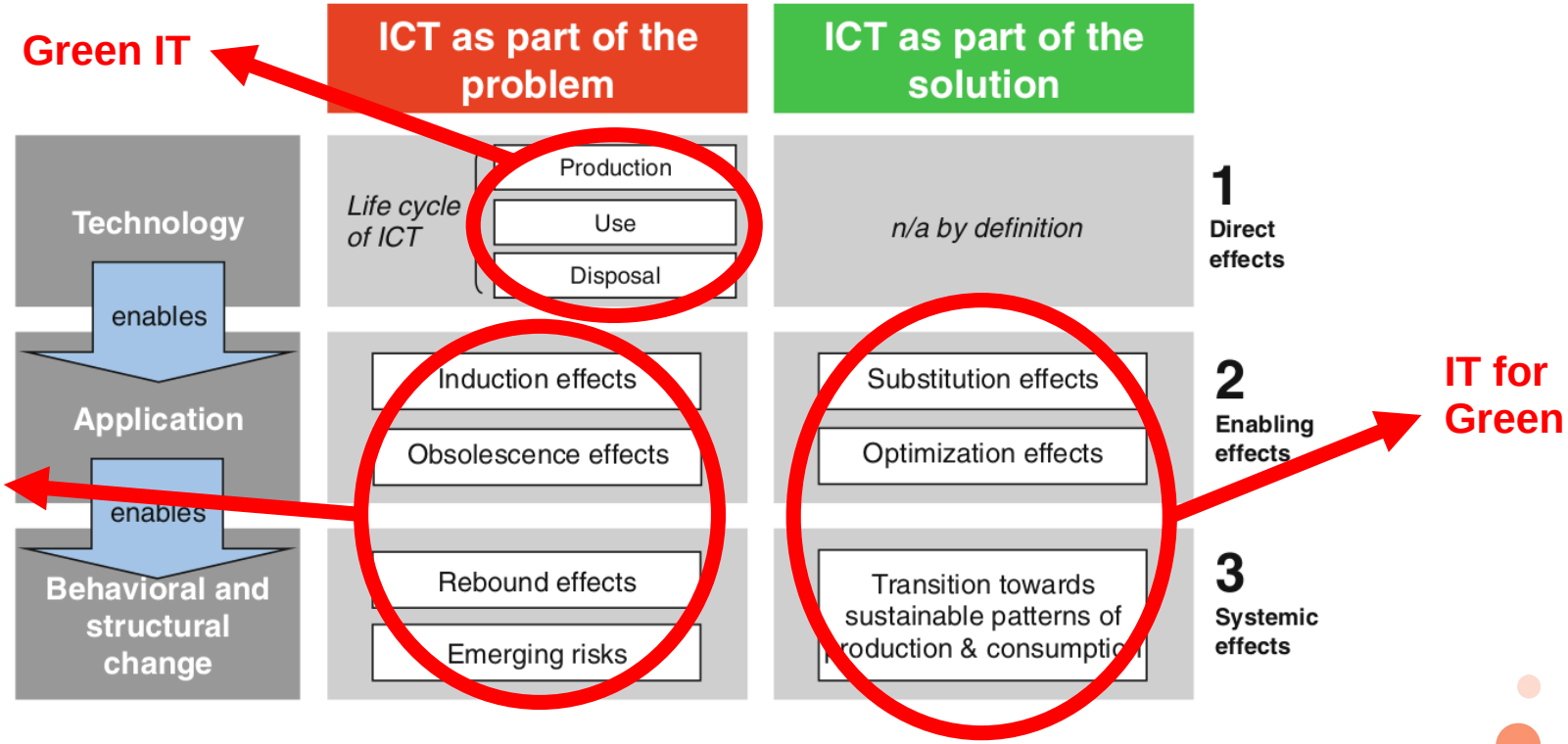
IT for Green

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.

Framework to think about ICT & sustainability



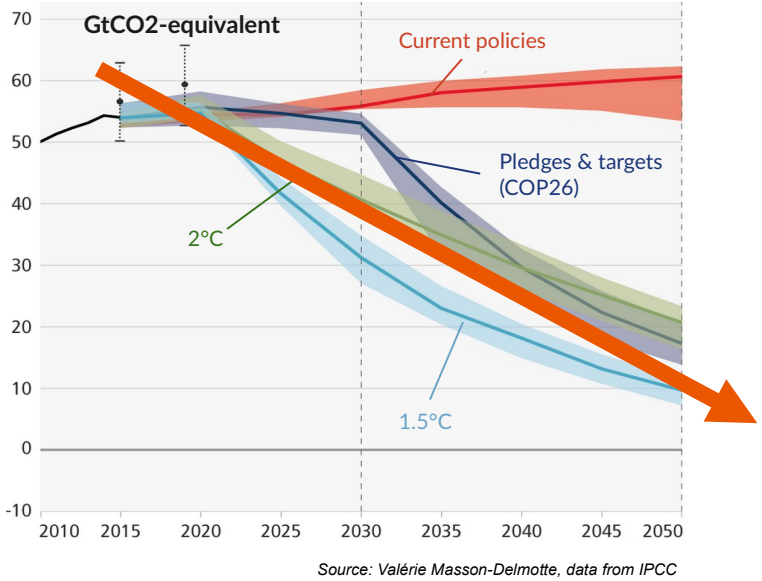
Hilty, L.M., Aebischer, B., 2015. *Ict for sustainability: An emerging research field*, in: ICT Innovations for Sustainability. Springer, pp. 3–36.

Green IT

Environmental impact of new technologies

Growing GHG emissions

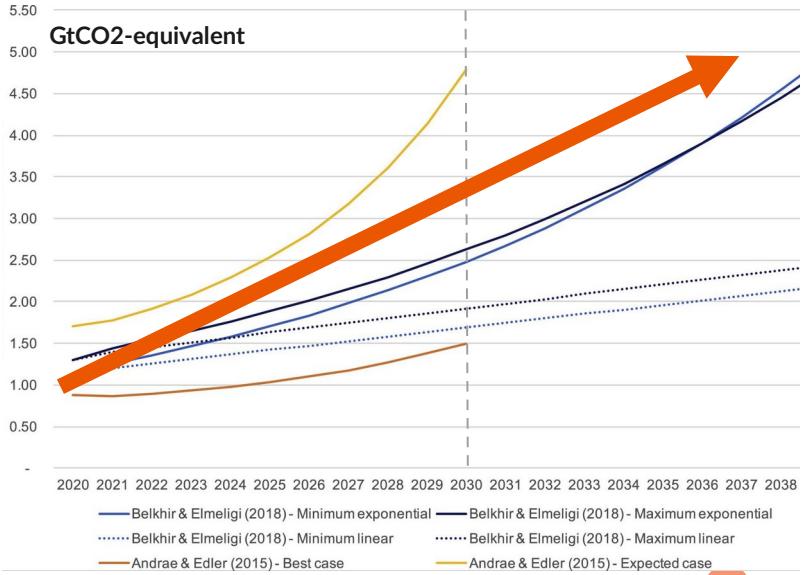
What we need to do:



Source: Valérie Masson-Delmotte, data from IPCC

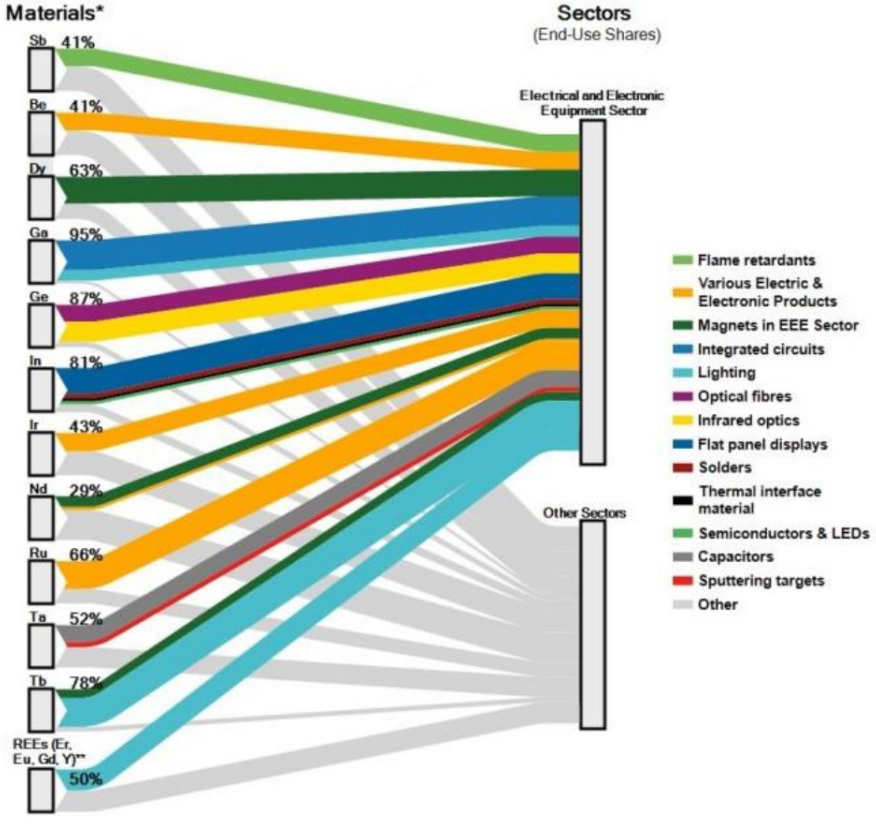
VS

ICT industry = 2-4% global GHG emissions



Source: Projections of ICT's GHG emissions from 2020, Freitag et al. 2021

Other env. impacts

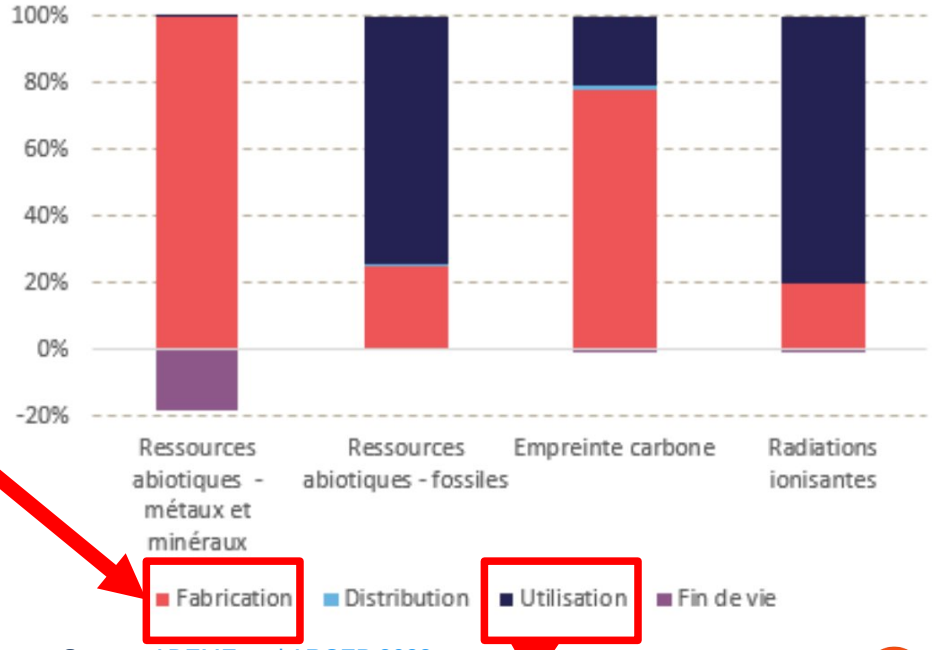


Source: https://publications.jrc.ec.europa.eu/repository/handle/JRC108710

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
- ...

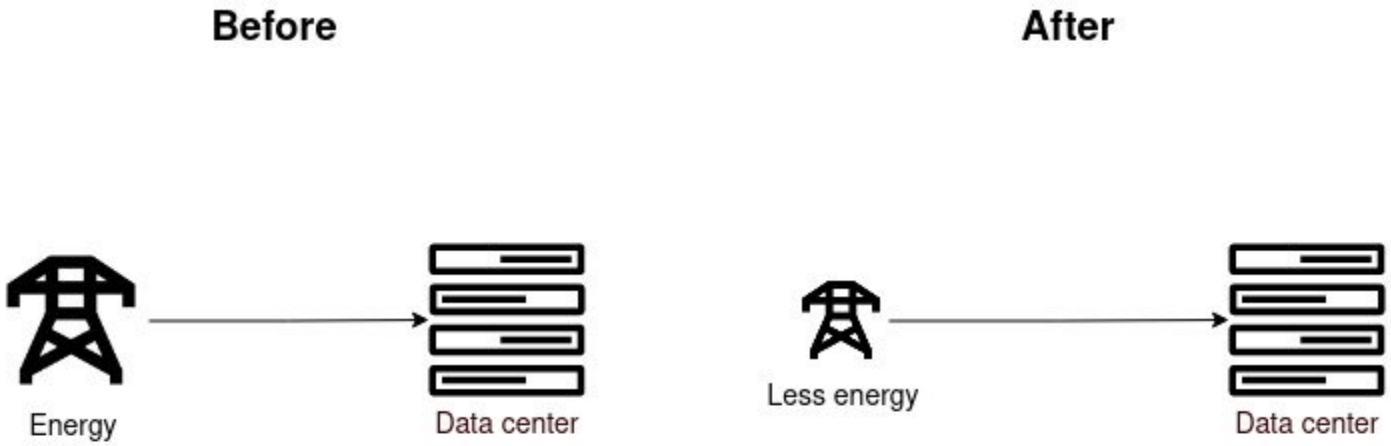
The rest from the **use phase:**

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

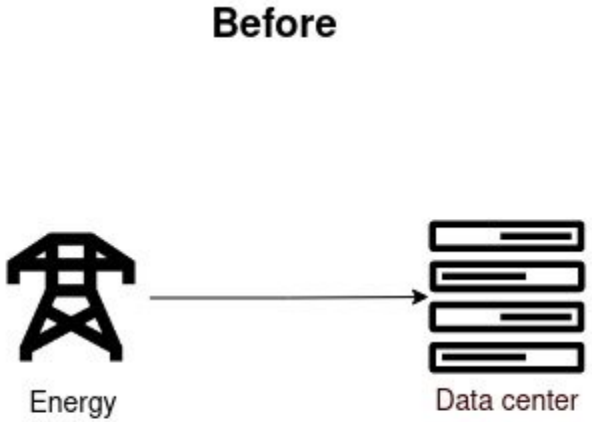
My PhD

Involving the users to mitigate
the environmental impact of data centers

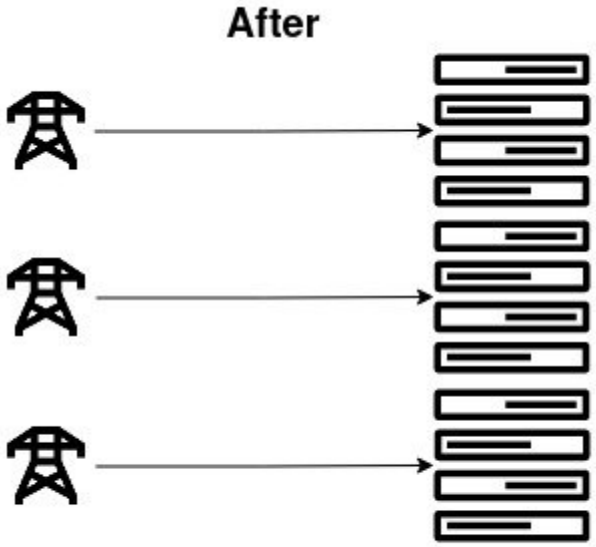
Simulation work



Rebound effect?

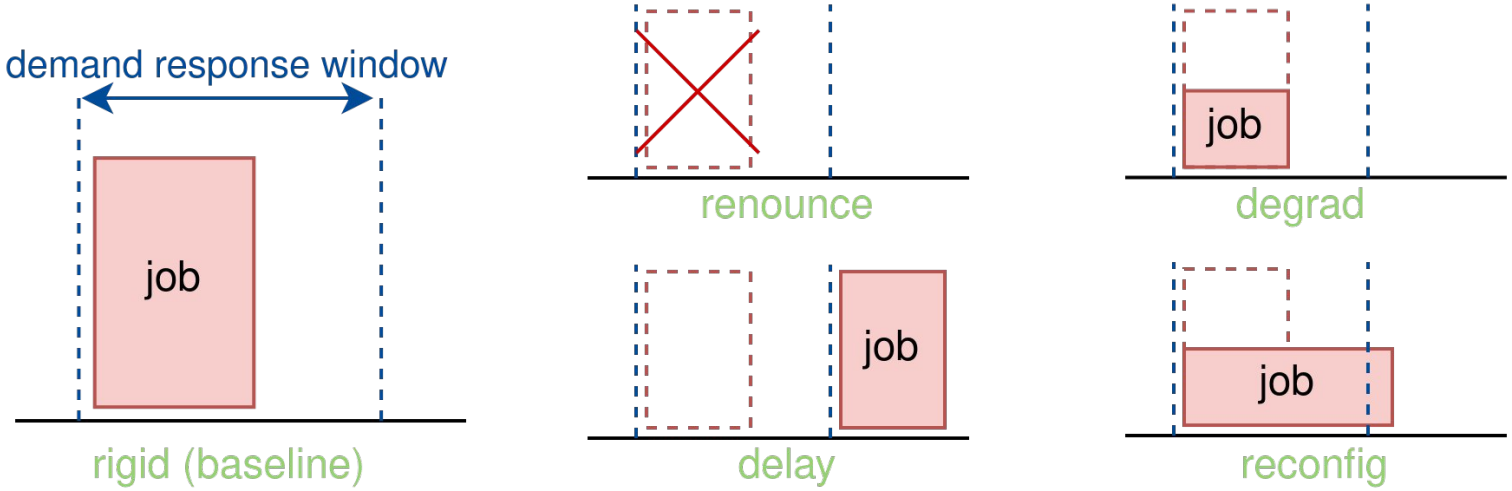


Data center = 1
Energy = 2



Data center = 3
Energy = 3

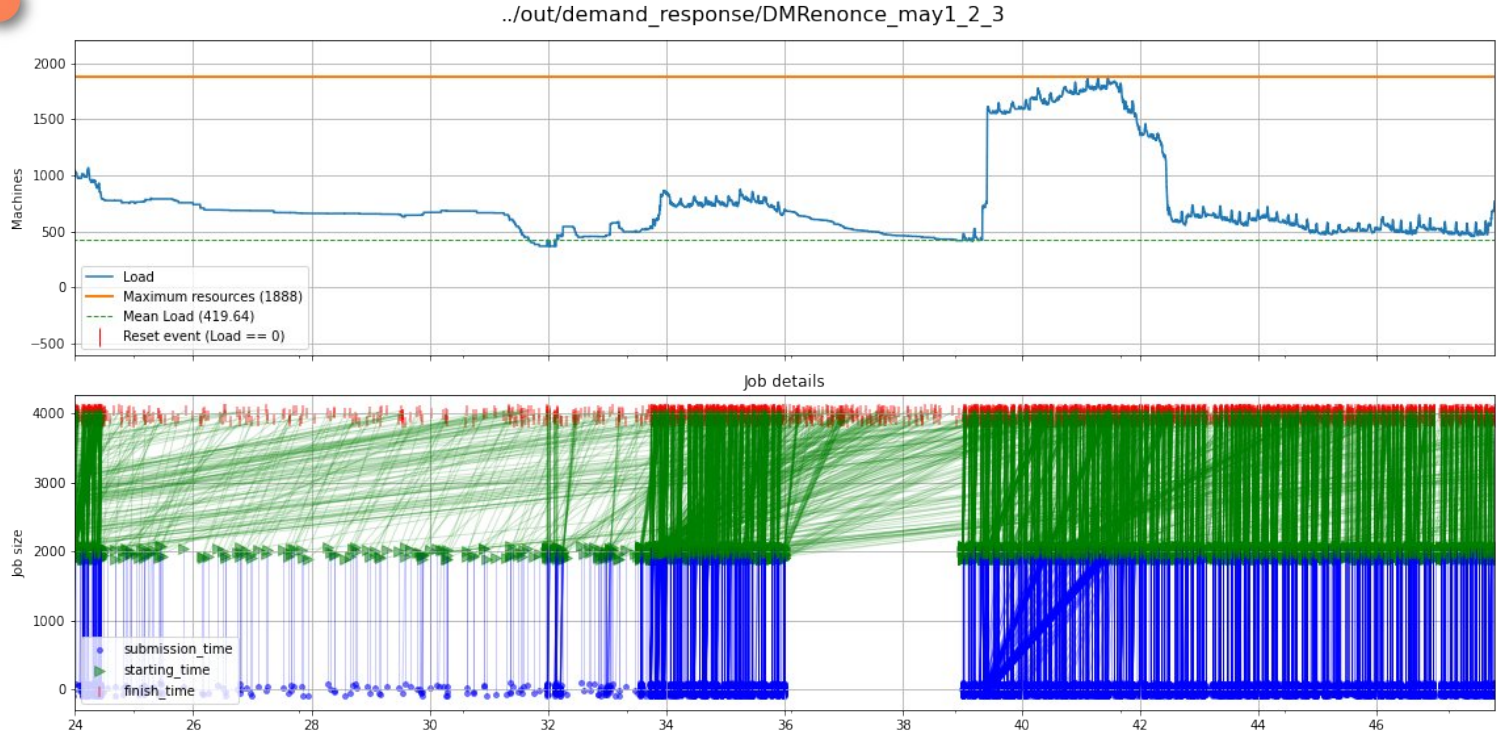
Submission behaviors



Rigid


../out/demand_response/ReplayRigid_may1_2_3
Machines
2000
1500
1000
500
0
−500
Load
Maximum resources (1888)
Mean Load (449.33)
Reset event (Load == 0)
Job details
Job size
4000
3000
2000
1000
0
submission_time
starting_time
finish_time
24
26
28
30
32
34
36
38
40
42
44
46

Renounce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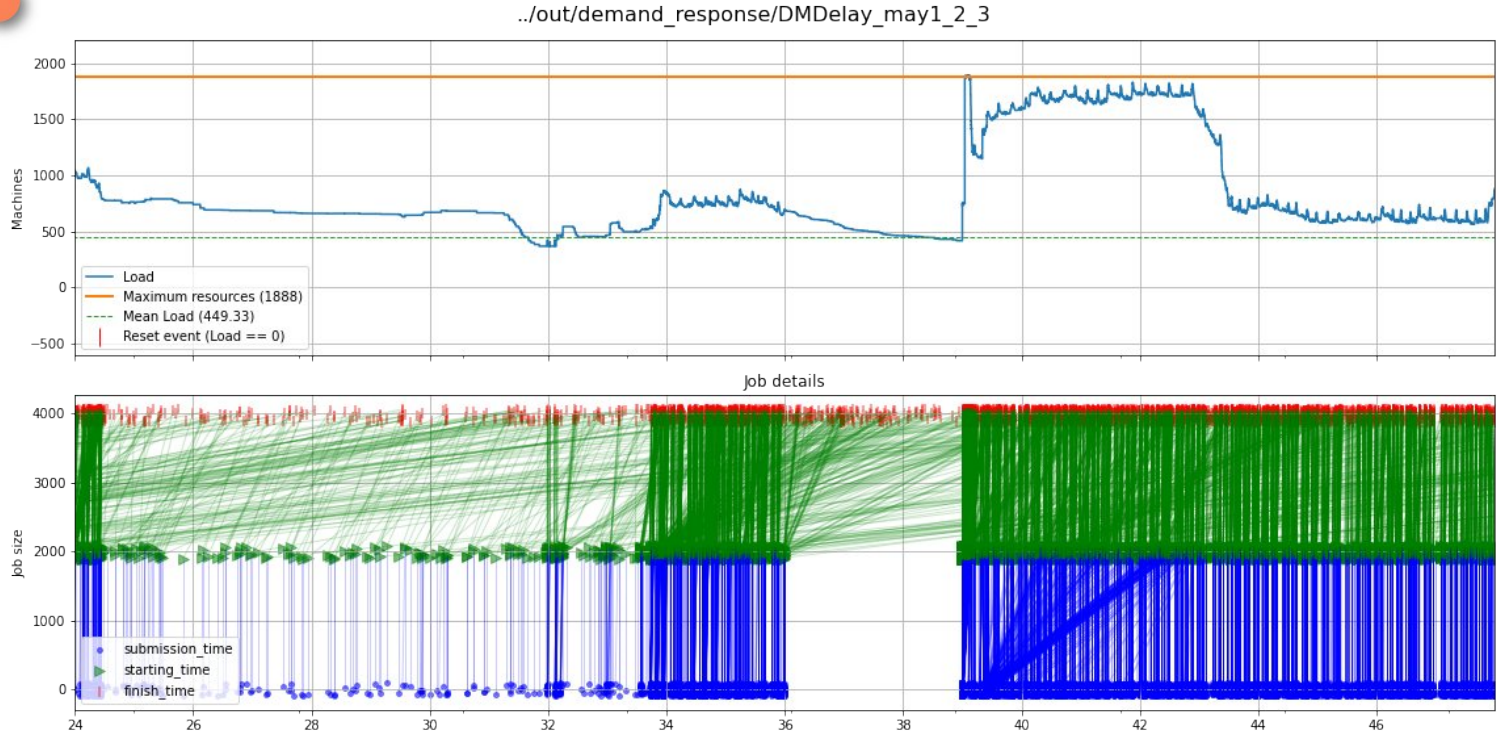
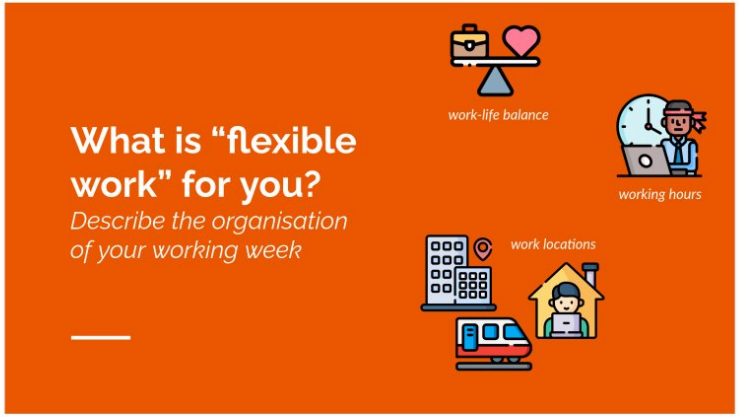
Machines
Load
Maximum resources (1888)
Mean Load (419.64)
Reset event (Load == 0)
Job details
Job size
submission_time
starting_time
finish_time

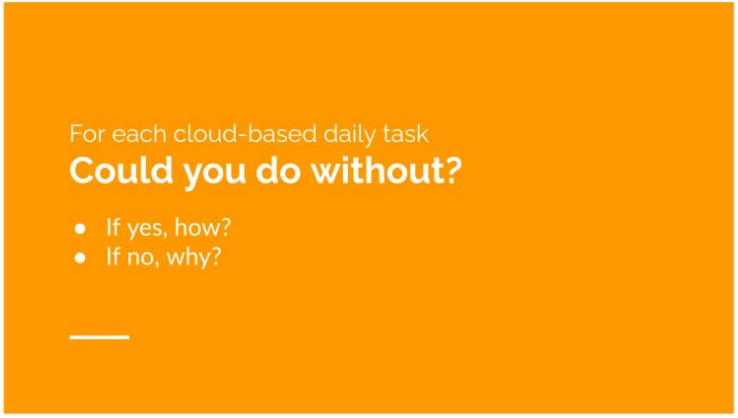
Delay


../out/demand_response/DMDelay_may1_2_3
Machines
2000
1500
1000
500
0
−500
Load
Maximum resources (1888)
Mean Load (449.33)
Reset event (Load == 0)
Job details
Job size
4000
3000
2000
1000
0
submission_time
starting_time
finish_time
24
26
28
30
32
34
36
38
40
42
44
46

Digital *sufficiency* at work

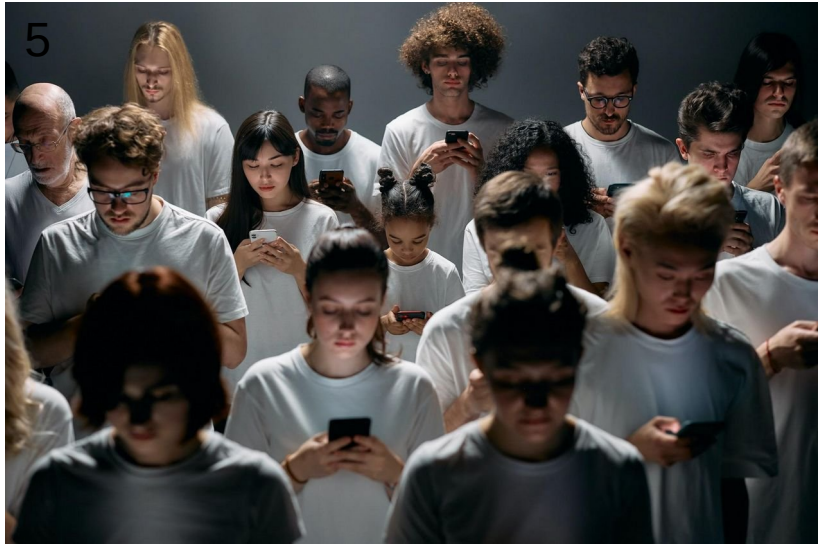
- **Study goal:** Re-design the use of cloud services for flexible working towards sufficiency
- How much digital interventions are *necessary* and how much is *superfluous*?
- **Method:** Focus groups within companies





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**
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  - mael.madon@irit.fr