ABOUT THE ESTIMATION OF THE ENERGY-COST OF DATA TRANSFER

A very simple question:

What is the cost of transferring data through the network(s), expressed, e.g., in J/GB or kWh/GB?

with no clear answer:

- macroscopic estimation, from the global Web energy consumption

2.7-to-3.6 kWh/Gb (Ong et al. 2012)

- microscopic estimations from the energy consumption of individual devices

13 Wh/Gb (from Montpellier to Paris, Ficher et al., 2020)

2-to-7 Wh/Gb (accounting for 8 routers on the way, Gelenbe, 2021;

but depending on the networks at stake the number of routers could be much larger !)

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When applied to the post-treatment of the CMIP6 data by different European climate centers (15 Pb of data having to travel back and forth, at least once, between centers and ESGF)

macroscopic estimation: 10^8 kWh

microscopic estimation: $2 \cdot 10^5$ kWh

to be compared with the 10^7 kWh necessary for the data production

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How to solve this 2-to-3 orders of magnitude difference ?

- follow the detailed path of data through the various networks they have to follow, and identify the devices on the way

- have measurements of energy consumption of all devices on the way (almost no measurements available presently)

- include typology of data exchange (for the same amount of transferred data it is much more costly when exchanging small packets rather than big packets)

- and …

Indeed a very long way to go before being able to answer the « simple » question !!

Actions prepared at the French level (ANRT, Acad. Technologies)