Project: CQuanDRI

CQuanDRI: Quantifying the Carbon Emissions of Digital Research Infrastructure

Abstract

This project will provide a measurement trace that captures the sustainability aspects in the operation of a DRI service, including dependencies between different indicators (e.g. data flow, power consumption, and carbon intensity).

This will answer questions such as:
- How does variability in the utilisation of infrastructure translate to energy consumption?
- Which are the indicators that minimise uncertainty of associated carbon footprints?
- How does the varying grid carbon intensity affect carbon footprints, and can this be exploited to reduce emissions?

The challenges outlined in the previous section are not unique to the context of the UKRI DRI but are shared with the IT sector at large. However, UKRI DRI owns and operates substantial infrastructure within the digital value chain. This presents a unique opportunity. In contrast, most digital media companies, such as the BBC or The Guardian, provide services over-the-top of infrastructure operated by third parties, including public cloud vendors and ISP network operators, and thus lack access to primary data. By leveraging end-to-end data from the partners, this project aims to demonstrate the feasibility of service-level quantification of carbon footprints.

The objectives of the project are to:
  i. Map the software architecture to physical infrastructure at some given location within the UK electric grid for a specific service;
 ii. Collect indicators of DRI infrastructure, software services and service-use, to represent current and dynamic carbon footprints and evaluate sources of variability and uncertainty of these indicators;
iii. Develop a prototype carbon footprint model of the service;
 iv. Apply the model to assess the influence that varying marginal grid carbon intensity has on carbon footprints and evaluate the potential carbon reductions from flexibility in DRI services.

The main deliverables of the project are:

- Open dataset of indicators relating infrastructure performance, software services and use.
- Results from a prototypical impact analysis of a service, including a characterisation of variability and uncertainty
- A report in form of a white paper

Institutions and representatives for this project

Bristol University – Daniel Schien

Oxford University – Noa Zilberman

STFC – Alastair Dewhurst

Newcastle University – David Greenwood

Funding information

This project has been awarded a total of £100,000 by the UKRI Net Zero DRI Scoping Project (NERC project NE/W007134/1). This funding is split between the institutions listed above.

Additional information

The UKRI Net Zero DRI Scoping Project will produce clear evidence and recommendations for a roadmap for the UKRI and their community to deliver carbon neutral DRI by 2040 or sooner.

The CQuanDRI sub-project was selected for funding following a sandpit event in May 2022. The proposals from teams were assessed on three factors; their excellence, potential to produce conclusive evidence and clarity of planning.

To read more about the UKRI Net Zero DRI Scoping Project visit our website.