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Attributing carbon to cloud
Blog for Business Green

Emma Fryer, Associate Director, Data Centres, techUK
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Cloud computing has become one of the dominant business models for government, businesses and, increasingly, consumers to manage their digital activities. Across the board, organisations are increasingly outsourcing to cloud: some are adopting external providers for new applications and retaining traditional IT functions while others are winding down their in-house IT and divesting their data centres. There are compelling reasons for this: the opportunity to move away from a capex-intensive business model to flexible service delivery on a pay-as-you-go basis is one: commissioning, designing, building and operating an enterprise data centre is not for the faint-hearted or the shallow-pocketed, so organisations for whom data centres are not core business are finding cloud very attractive. Cost is usually a significant factor and the choice of public, private and hybrid models addresses sensitivities about data security and control.

Cloud computing is also significantly more energy efficient than more traditional alternatives. Recent industry studies by Microsoft[1] and Google[2] both set the energy savings resulting from such a move at over 90%, delivered through a combination of IT hardware and operational efficiency and data centre infrastructure optimisation.

It's easy to see why cloud computing should be much more efficient than traditional approaches. Cloud is the culmination of technical trends like virtualisation and consolidation. Workloads move to where there is capacity and this allows hardware and supporting infrastructure to be optimised, increasing utilisation and minimising resource use. Cloud services are often location agnostic so operators can develop facilities close to under-used renewable sources in places like Scandinavia.

But can we prove it? How can a public authority demonstrate in a Select Committee hearing that their move to cloud has been a sustainable transition? How does a media business report its scope 3 carbon after moving from printed to digital outputs? When companies run things in-house, they have access to relevant energy use data because they control the processes and pay the bills. But when a service is delivered by a third party the energy impact of that activity may be less transparent. Organisations need to attribute energy and carbon to these cloud services robustly enough to be confident that their outsourcing decision is indeed delivering environmental benefits.

The problem is that attributing energy and carbon to a specific cloud service or customer is tricky, and often fiendishly complex. Workloads are virtualised and moved not just between servers and

[1] See The Carbon Benefits of Cloud Computing: https://www.microsoft.com/en-us/download/confirmation.aspx?id=56950
[2] Copenhagen Economics, European Data Centres: https://www.copenhageneconomics.com/dyn/resources/Filelibrary/file/9/109/1525764693/copenhagen-economics-2018-european-data-centres-case-study-ireland.pdf

facilities but between regions in order to optimise hardware resources and minimise energy consumption. Different operational efficiencies and carbon conversion factors apply. Moreover, cloud business models are generally made up of different layers of service provided by multiple suppliers.

So, with these challenges in mind, how do customers establish the energy associated with the cloud services they buy? After an extended dialogue with public sector (HMG Sustainable Advice and Reporting Team)[3] and media companies, we came up with the following suggestions.

- Ask the provider, ideally at the pre-procurement stage. The more these requests are made, the more likely that information will be provided.
- Calculate carbon using a tool like the GHG Protocol, or to commission a third party study. These are invaluable but can be costly.
- Estimate using simple criteria that are robust enough to inform decision making. Examples are cost, energy source, PUE[4], utilisation and server refresh (old servers are very inefficient, so servers should be replaced regularly). Metrics like these are increasingly supported by international, peer reviewed standards to ensure they are robust and applied consistently.
- Compare with known examples: academic or commercial research or case studies.

We included these suggestions, along with some contextual information, in a report: *Lost in Migration: attributing carbon to data centre and cloud services*, published in October 2019.

There are broader issues to consider. ICT is increasingly becoming a utility like electricity or water, and highly price-elastic. We flush our toilets and wash our cars with drinking-quality water because it is cheap. Similarly, the more efficient cloud is, the more we use it, and this can encourage profligacy[5]. The widely adopted freemium and advertorial business models are very effective in driving innovation, but do not give consumers any indication that activities like video streaming have an energy impact elsewhere in the system.

So where are we? It's clear that the energy we use when accessing cloud services could be more transparent. While by its nature, cloud computing is far more efficient than alternative approaches, customers cannot simply assume this. Businesses and public sector bodies increasingly wish to account for their scope 3 carbon emissions and need robust energy data to inform their decision making. Consumers too need to understand the energy impacts of their online activity. Whether at work or at home we all need to be responsible digital citizens, but without insight into our impacts we will struggle to make the right choices.

We anticipate that over time, transparency will improve for all types of cloud customer, and in doing so, other net gains from cloud computing, such as lighter mobile devices, truly mobile working through online collaboration tools may also become more transparent. Assessing these impacts, getting the system boundaries right and keeping pace with ever-changing technology will continue to present challenges for a long time to come.

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[3] (STAR) responsible for greening government ICT and improving reporting across the public sector.

[4] PUE: power usage effectiveness, the ratio of the energy entering the facility to that consumed by the IT within it

[5] See Jevons Paradox. Jevons was a 19th Century economist who predicted that improvements in production efficiency lead to greater overall consumption.