GREENOPS IN THE CLOUD

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Bristol DevOps & Cloud Native Meetup
27 September 2023

WHOAMI_

I’m a senior consultant at The Scale Factory

The Scale Factory is a **cloud infrastructure** consultancy based in the UK and dedicated to **helping SaaS businesses** to grow

TOPICS COVERED_

1. Carbon emissions in IT and GreenOps
2. 10 practical tips to mitigate carbon footprint in the cloud
3. Holding cloud vendors accountable for carbon emissions
4. Conclusions

CARBON EMISSIONS IN IT AND GREENOPS_

THE PROBLEM_

“Even without taking into account the cryptocurrency boom, the global ICT sector emits as much greenhouse gases as the aviation sector.”

Source: Allianz Research, 2023

“Data centres and data transmission networks are responsible for 1% of energy-related GHG emissions [..] and each accounts for 1-1.5% of global electricity use.”

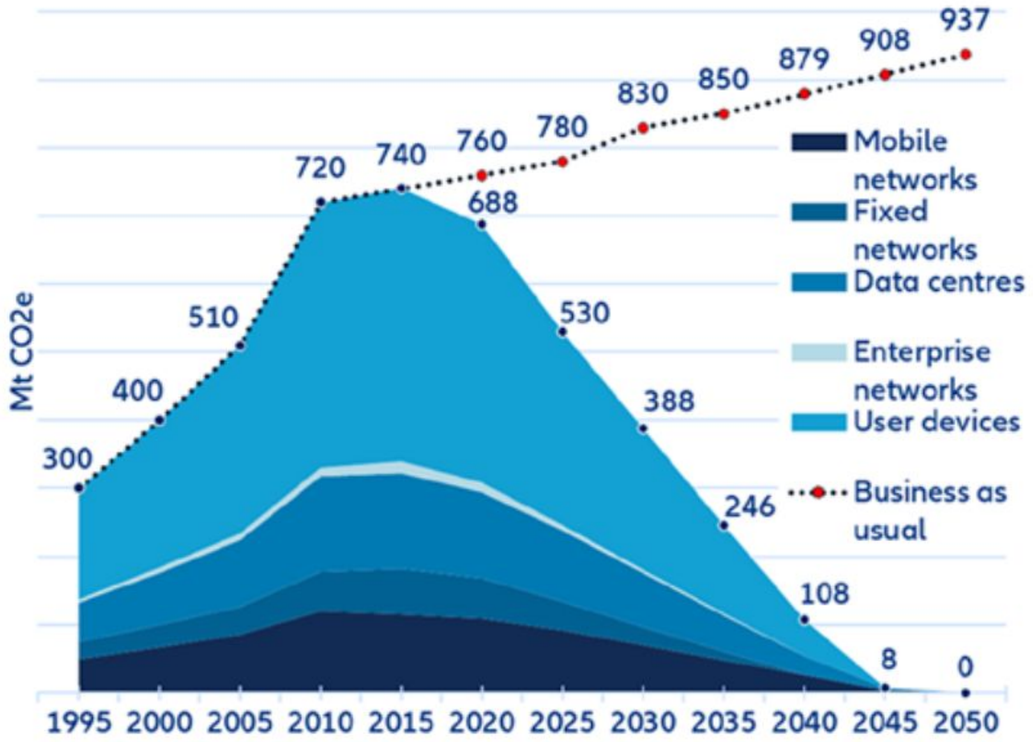
Source: IEA (International Energy Agency), 2023

CAVEATS_

- **It depends** how greenhouse gas (GHG) emissions are calculated (e.g. scope 1/2/3 emissions, including/excluding manufacturing of devices, impact of GHG with high-altitude effects, etc.)
- Some analysts (Gartner - 2007, Allianz - 2023) suggest that ICT's GHG are **comparable or larger than the aviation industry**, others don't (Ericsson - 2020, techUK - 2021)
- **Finding comprehensive data** can be challenging
- But the **ICT sector plays a role** in GHG and **keeps growing**

ICT SECTOR GLOBAL GHG PREDICTIONS_

Figure 1: Global GHG emission trajectories of the ICT sector for 1.5˚C scenario



Sources: ITU-T, Malmodin. J (2020), Freitag et.al (2021), Allianz Research. Note:

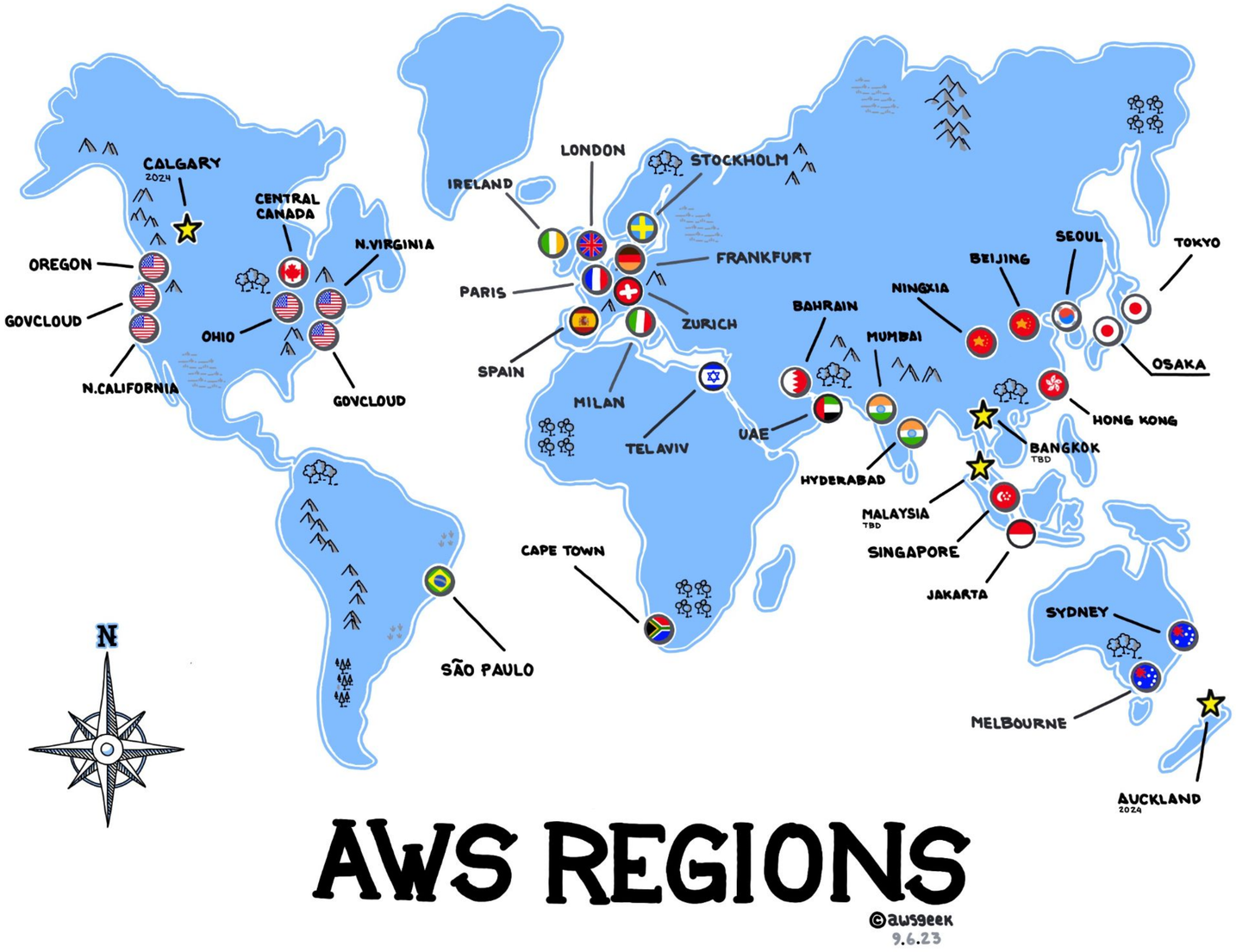
GREENOPS_

- GreenOps is an operating model aimed at **optimising the efficiency of the cloud** while **minimising its environmental impact**
- GreenOps provides a methodology that helps us **designing cloud architectures** while **taking into account their carbon footprint**.

10 PRACTICAL TIPS TO MITIGATE CARBON FOOTPRINT IN THE CLOUD_

1. USE CLOUD REGIONS RUNNING ON RENEWABLE ENERGY_

AWS REGIONS_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ZURICH
SPAIN
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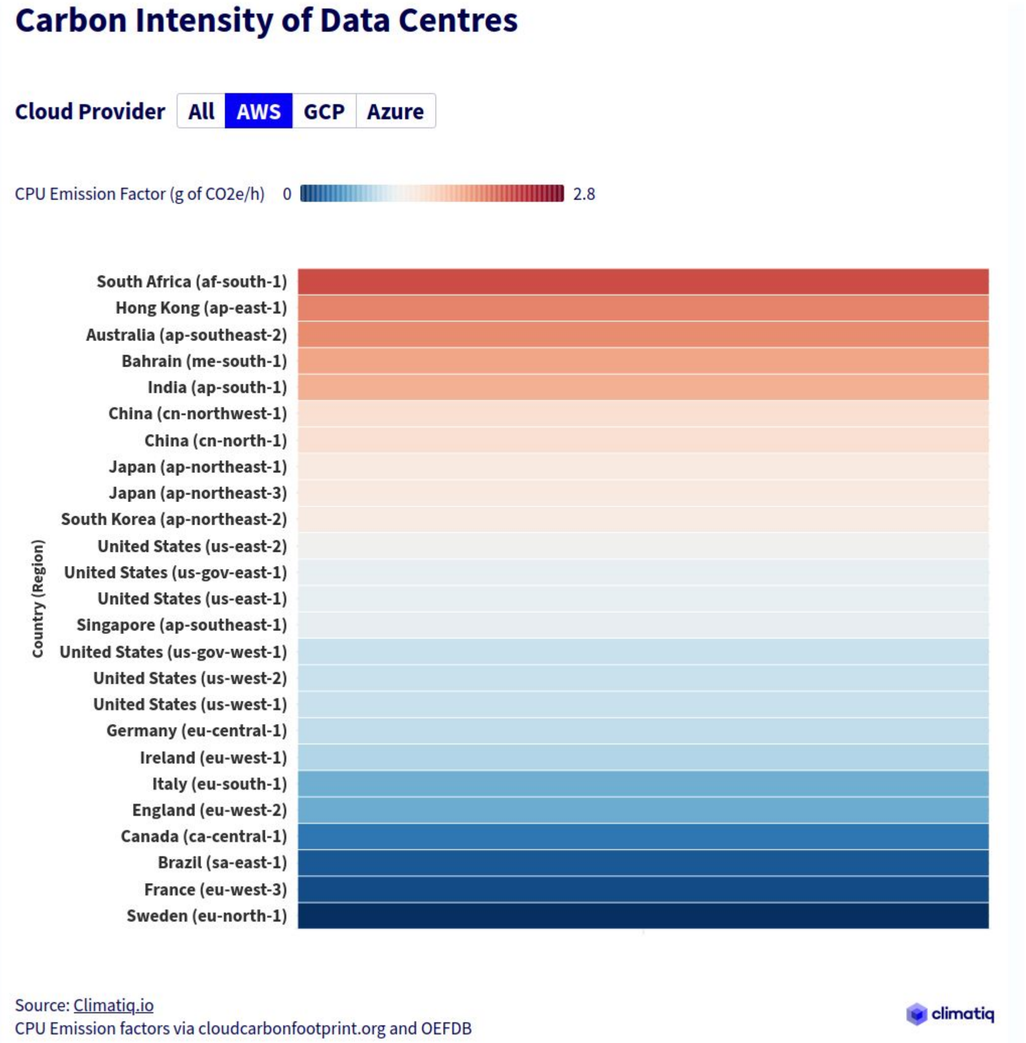
CARBON INTENSITY OF AWS REGIONS_



https://www.climatiq.io/blog/measure-greenhouse-gas-emissions-carbon-data-centres-cloud-computing

CHOOSING A CLOUD REGION_

Things to consider:

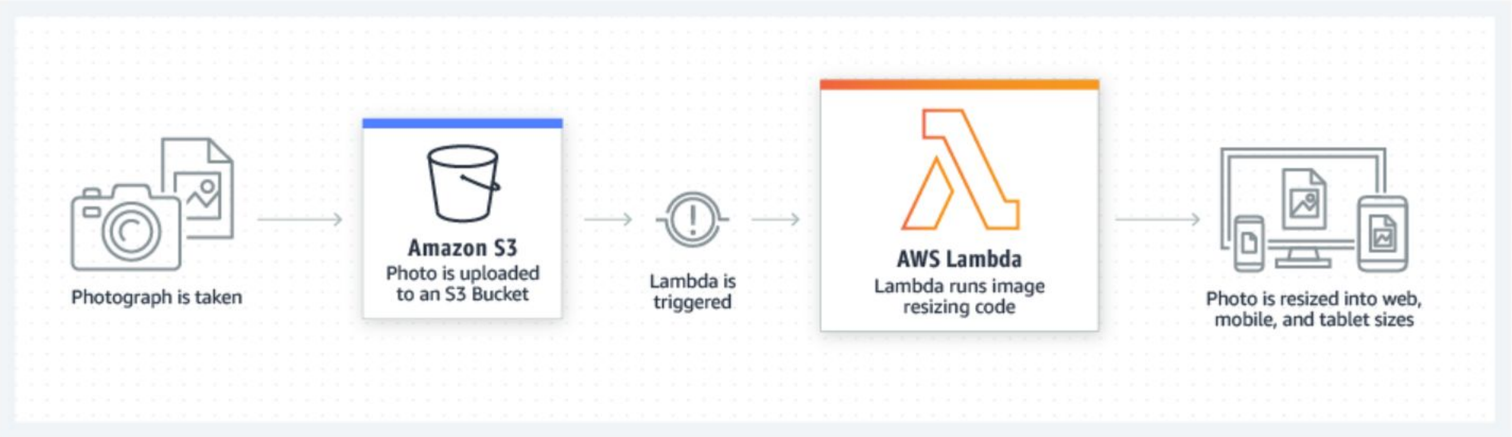
- Latency
- Compliance (e.g. data residency)
- Services and features
- Cost
- Sustainability (e.g. environmental impact)

2. DESIGN SERVERLESS AND EVENT-DRIVEN ARCHITECTURES_

SERVERLESS ARCHITECTURE_

- A serverless architecture is a way to build and run applications **without having to manage infrastructure**
- The application still runs on servers, but all the **server management is done by the cloud provider**
- You **no longer** have to provision, scale, and **maintain servers**

SERVERLESS ON AWS_



3. RIGHT-SIZE, MAXIMISE UTILIZATION, AND STOP UNUSED RESOURCES_

STRATEGIES_

- **Right-size** resources using AWS Trusted Advisor and AWS Cost Explorer
- Use autoscaling to **scale out** but also to **scale in** resources
- **Maximize utilisation** of resources
- **Stop unused/idle resources** (e.g. during out-of-office hours and weekends)

QUOTE_

“The greenest energy is the energy we don’t use”

Peter DeSantis

VP of AWS Global Infrastructure

Photo © Crunchbase

4. SWITCH TO POWER EFFICIENT CPU/GPU PROCESSORS_

PROCESSORS_

- Switch to instances using power efficient processors like **AWS Graviton 2/3**-based instances (ARM based, 2-3.5 times better CPU performance per watt than other processors in AWS)
- Better price performance too
- ⚠️ Not all workloads are suited for **ARM based processors**

5. USE RESERVED AND SPOT INSTANCES_

RESERVED INSTANCES_

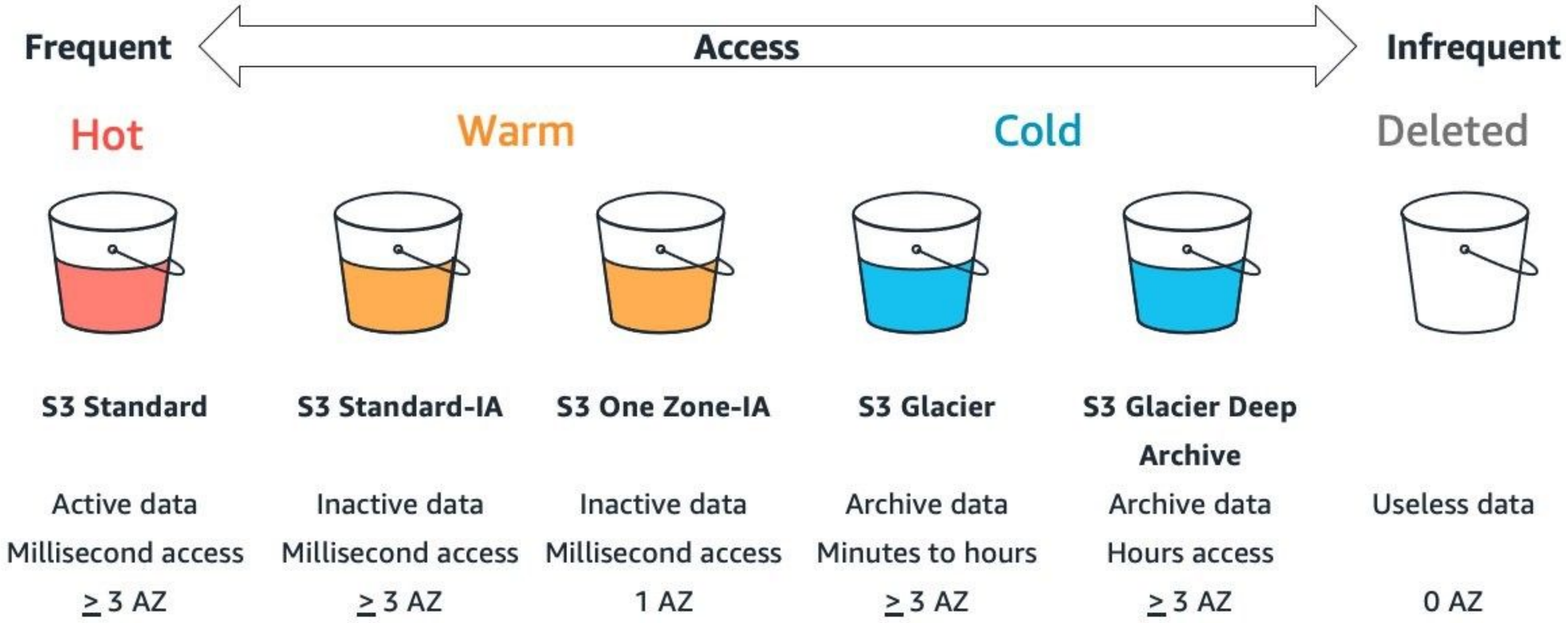
- Reserved instances is a **billing discount** applied to on-demand instances in return for **committing to a specified level of usage**
- Reserved instances allow cloud providers to better manage their **capacity planning**
- ⚠️ They provide a significant discount (up to 75%) but require an upfront commitment for 1 to 3 years

SPOT INSTANCES_

- Spot instances are instances that uses **spare compute capacity available at a specific time** and provide significant discounts compared to on-demand prices
- Spot instances take advantage of **unused capacity** in AWS
- ⚠️ Not all workloads are suitable for running on spot instances

6. STORE YOUR DATA EFFICIENTLY_

S3 STORAGE CLASSES_

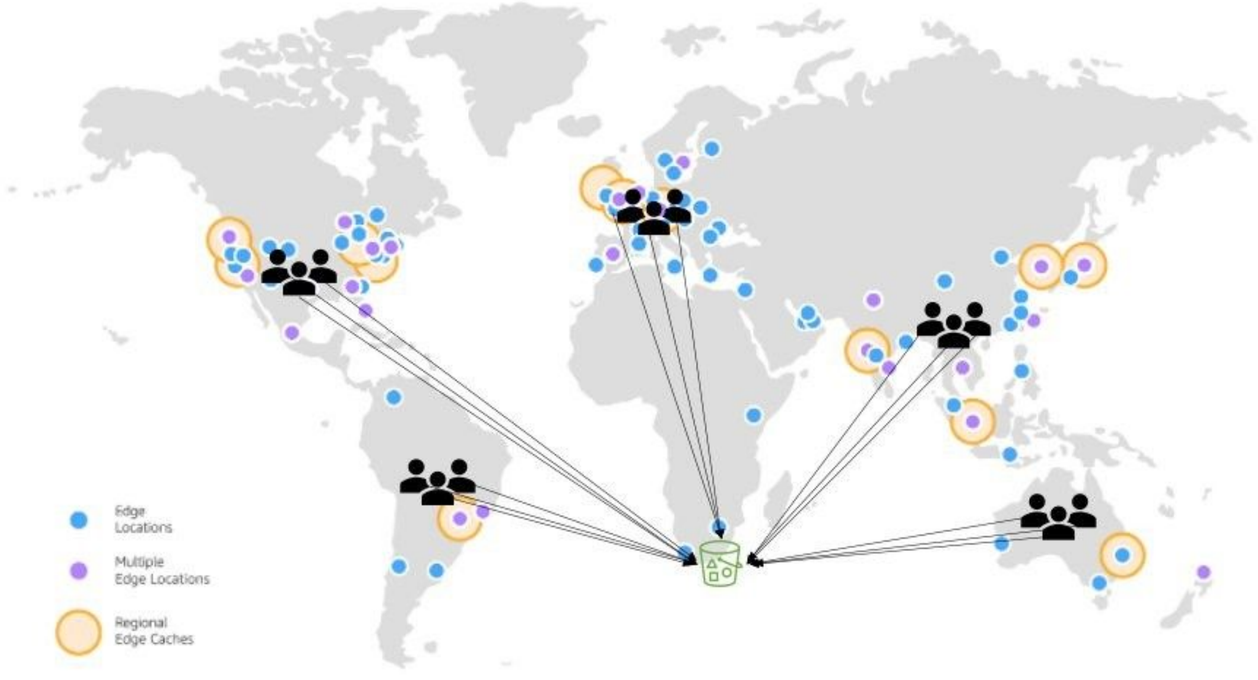


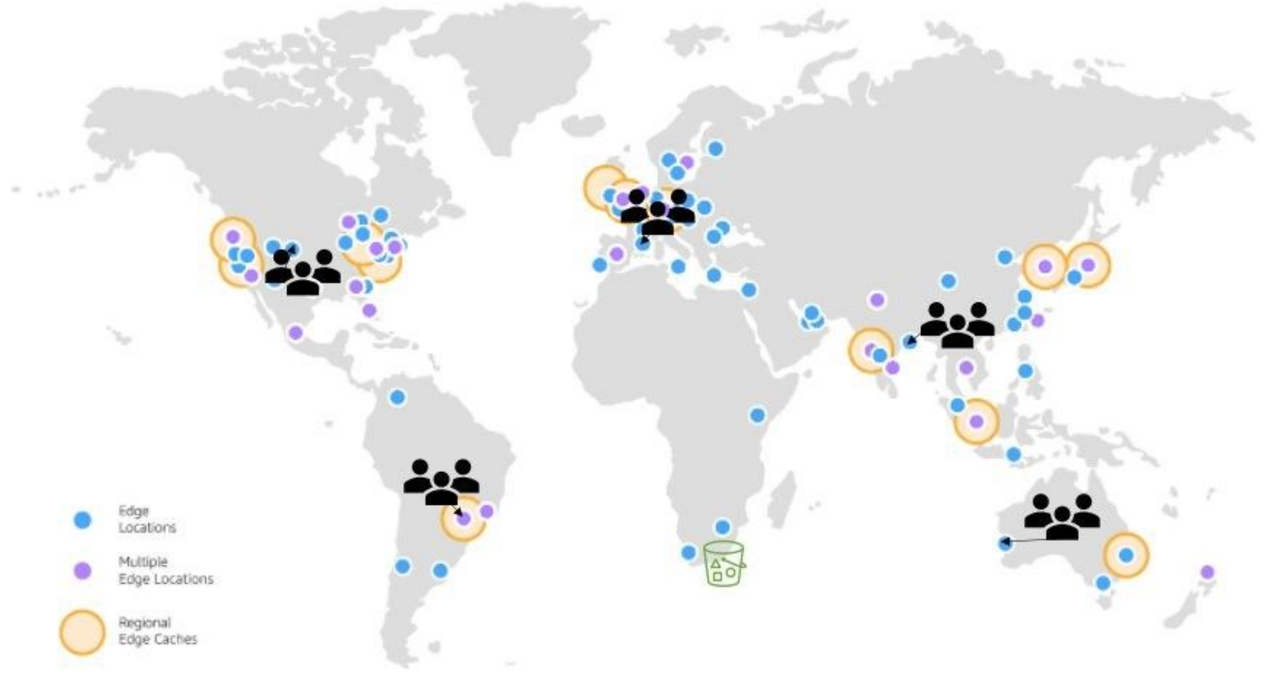
7. USE A CONTENT DELIVERY NETWORK (CDN) _

CONTENT DELIVERY NETWORK_

- A Content Delivery Network (CDN) is a distributed group of servers that **caches content near end users**
- A CDN caches static content from the original server and delivers it to the user. This **shortens the distance each packet has to travel** over the Internet
- AWS Trusted Advisor has a **check that recommends whether you should use a CDN** for your S3 buckets

ACCESSING S3 BUCKET DIRECTLY VS VIA CLOUDFRONT/EDGE LOCATIONS





8. USE MANAGED SERVICES_

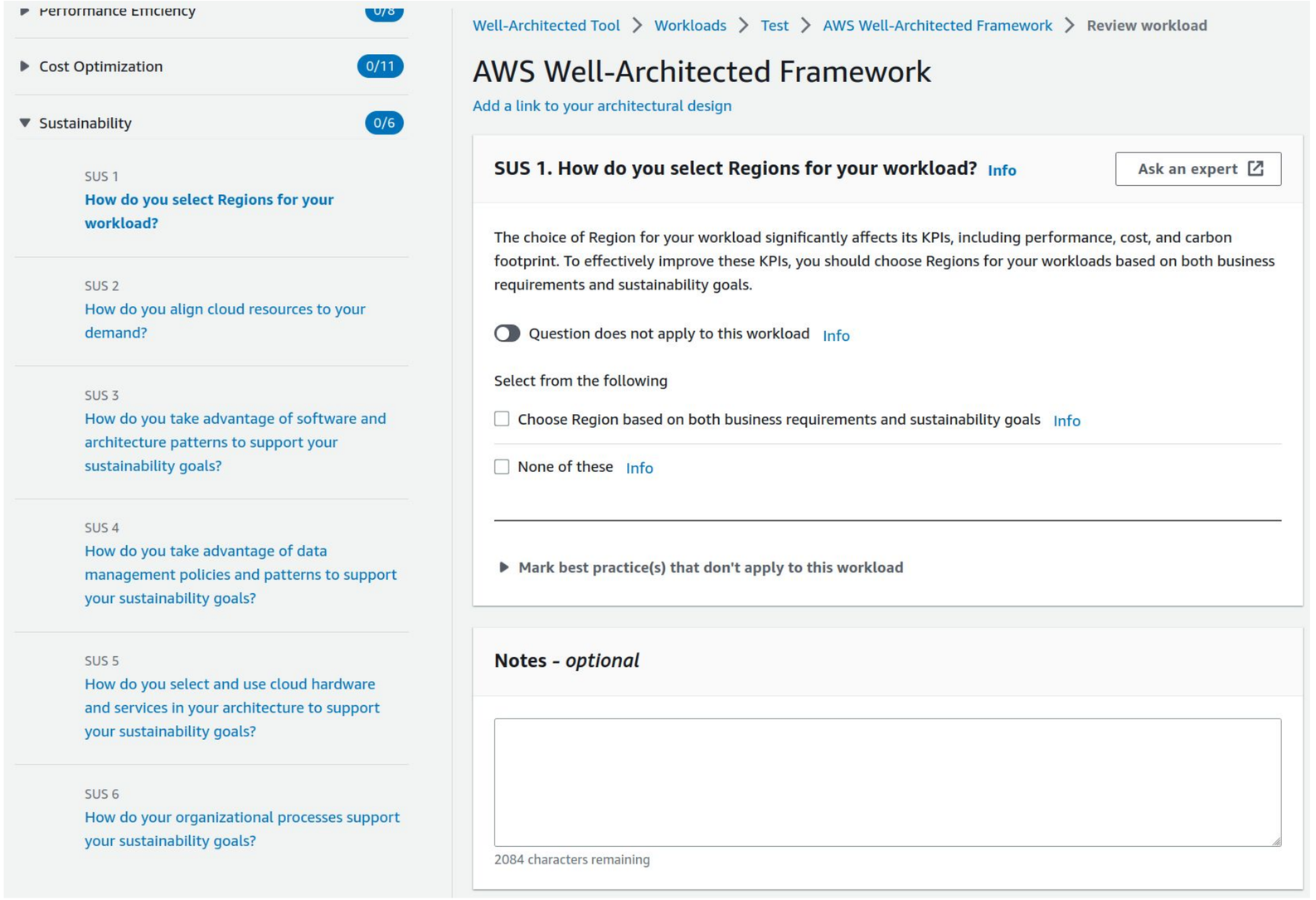
MANAGED SERVICES_

- Managed services are services **operated and maintained directly by the cloud provider** (databases, Kubernetes clusters, etc.)
- The cloud provider **manages them more efficiently** than you can ever do on your own servers
- E.g. RDS for databases, Fargate/EKS for containers/Kubernetes clusters, etc.

⚠️ They tend to be **more expensive but** you **save on operational costs**

9. PERFORM A WELL-ARCHITECTED REVIEW

WELL-ARCHITECTED REVIEW (WAR)_



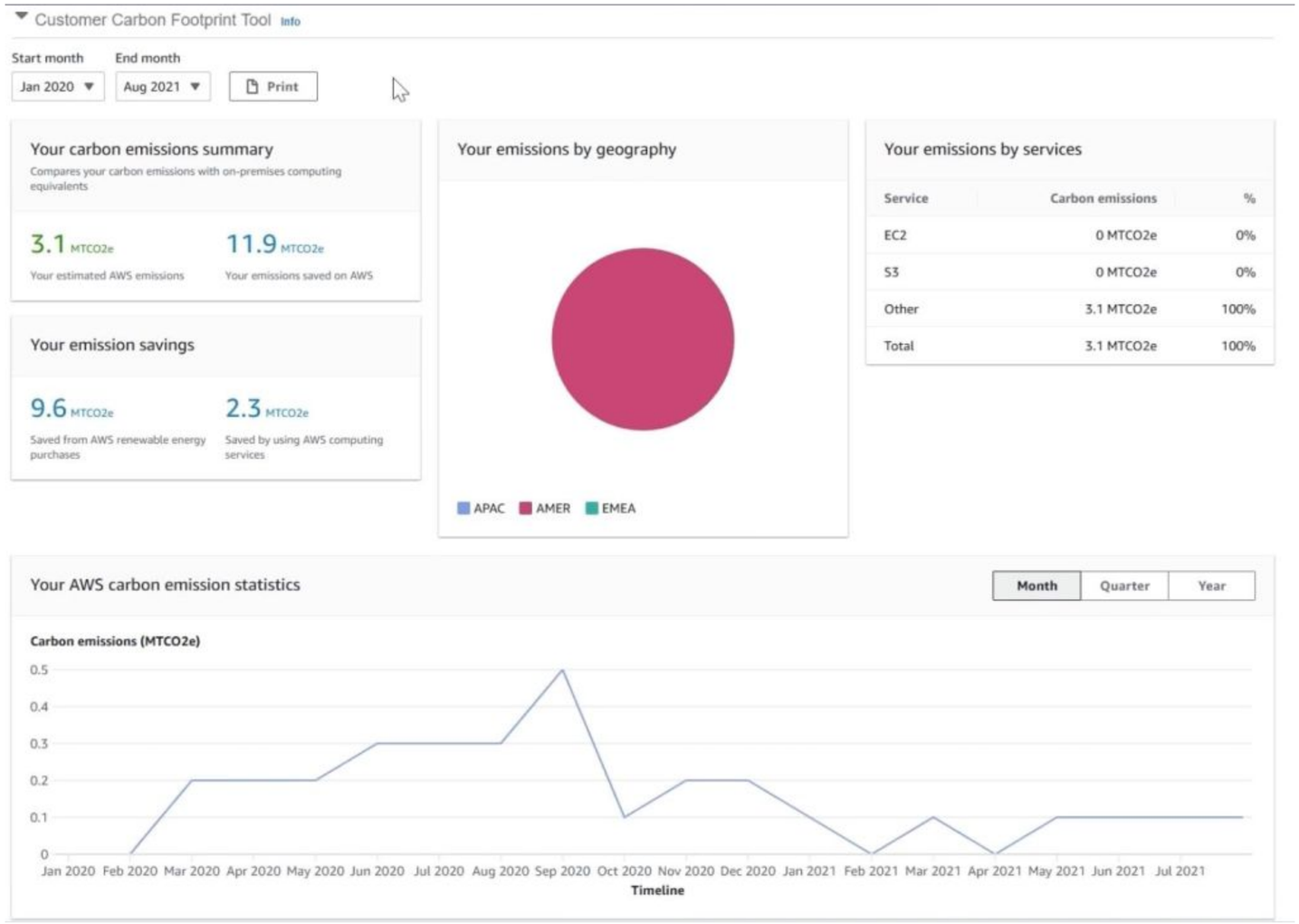
BOOK A WAR_

At The Scale Factory we provide **free AWS Well-Architected Reviews**:

https://www.scalefactory.com/consulting/packages/well-architected/

10. CARBON FOOTPRINT TOOLS_

AWS CARBON FOOTPRINT TOOL_



3RD PARTY CARBON FOOTPRINT TOOLS_

- Climatiq provides an API for calculating carbon emissions of cloud services
- Greenly provides cloud GHG assessments
- Cloud Carbon Footprint is an open source tool allowing to create apps monitoring your cloud carbon footprint

HOLDING CLOUD VENDORS ACCOUNTABLE_

GREEN WASHING _

Green washing is a **false, misleading or untrue action made by an organization about the positive impact** that a company, product or service has **on the environment**

HOLDING CLOUD VENDORS ACCOUNTABLE _

- Be aware of **green washing** when evaluating claims made by cloud providers
- Ask for **more transparency** and independent scrutiny of data
- **Compare** what different cloud providers are doing to reduce their carbon emissions
- **Make your voice heard as a customer** of cloud providers

CLIMATE COMMITMENTS _

Tech Company Climate Commitments Comparison

Company	2018 Carbon Footprint (MtCO2e)	Renewable Energy Matching Deadline	Fossil Fuel Phase Out Deadline	Reliant on Unbundled RE Credits?	Supply Chain Emission Reduction goal?	AI for Oil Contracts?
aws	44.4	2030[i]	None	Yes	No	Yes
Microsoft	17.6	2025	None	No	Yes	Yes
Google	15	2017	Ongoing[ii]	No	Yes	Yes[iii]

[i] Amazon has not stated that it will match its data center energy demand with real and additional renewable energy projects, and to-date has in part used lower-impact renewable energy credits to make its RE claims.

[ii] While Google has no public deadline, it aims to power its data centers with carbon-free energy 24x7.

[iii] Google stated it will no longer develop custom AI/ML solutions to facilitate upstream extraction.

Greenpeace (2020), https://www.greenpeace.org/usa/reports/oil-in-the-cloud/

CONCLUSION & TAKEAWAYS_

- **Be aware** of the carbon footprint of the ICT sector
- **Use some of the practical tips** I gave you to mitigate your carbon footprint in the cloud
- **Make cloud vendors accountable** for their carbon emissions

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