

# GREENOPS IN THE CLOUD

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**WHOAMI\_**



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**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

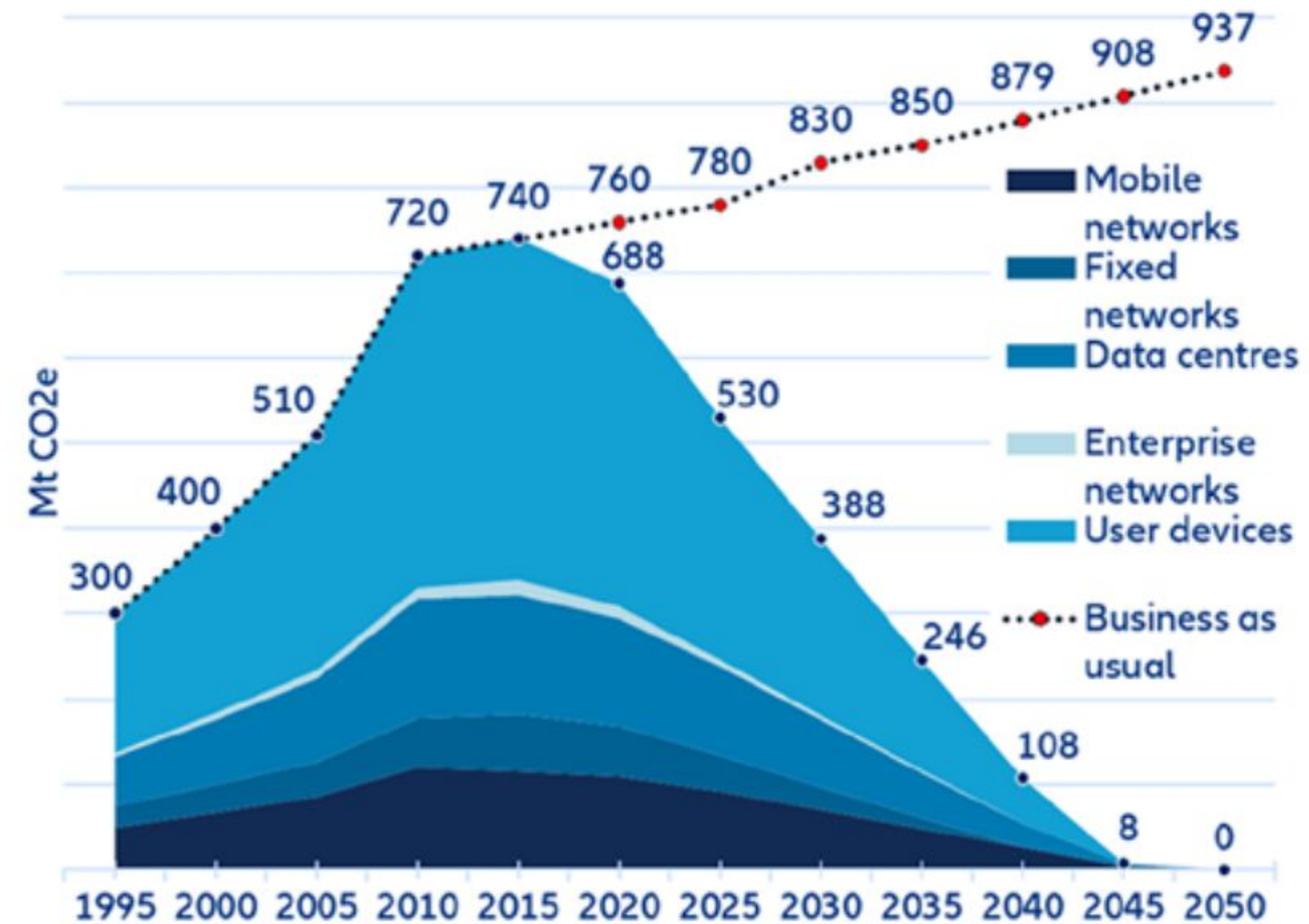


## CAVEATS

- **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, Malmudin. 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



# AWS REGIONS

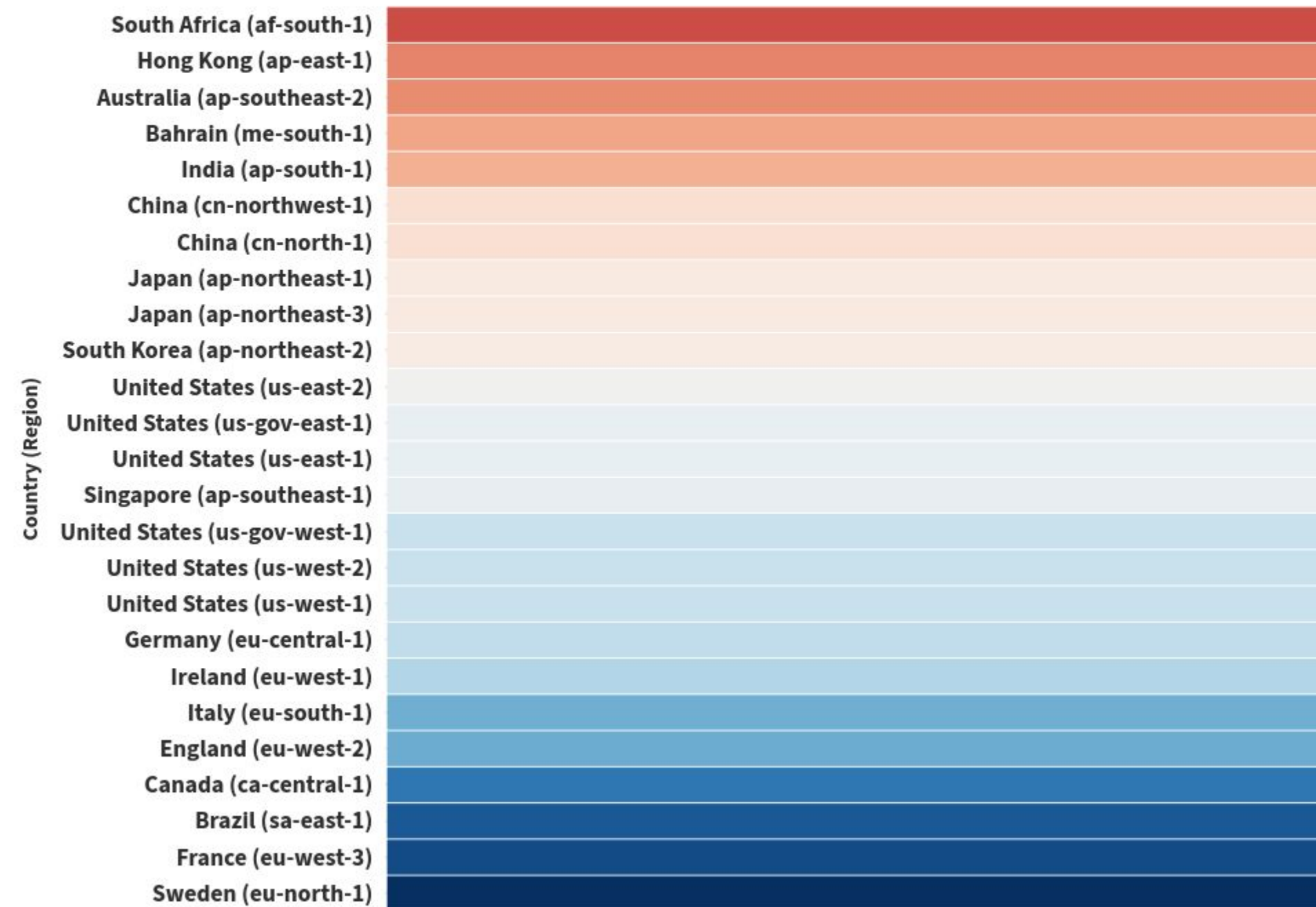
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# CARBON INTENSITY OF AWS REGIONS

## Carbon Intensity of Data Centres

Cloud Provider **All** **AWS** GCP Azure

CPU Emission Factor (g of CO<sub>2</sub>e/h) 0  2.8



Source: [Climatiq.io](https://www.climatiq.io)  
CPU Emission factors via [cloudcarbonfootprint.org](https://cloudcarbonfootprint.org) and [OEFDB](https://oefdb.org)



<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\_**

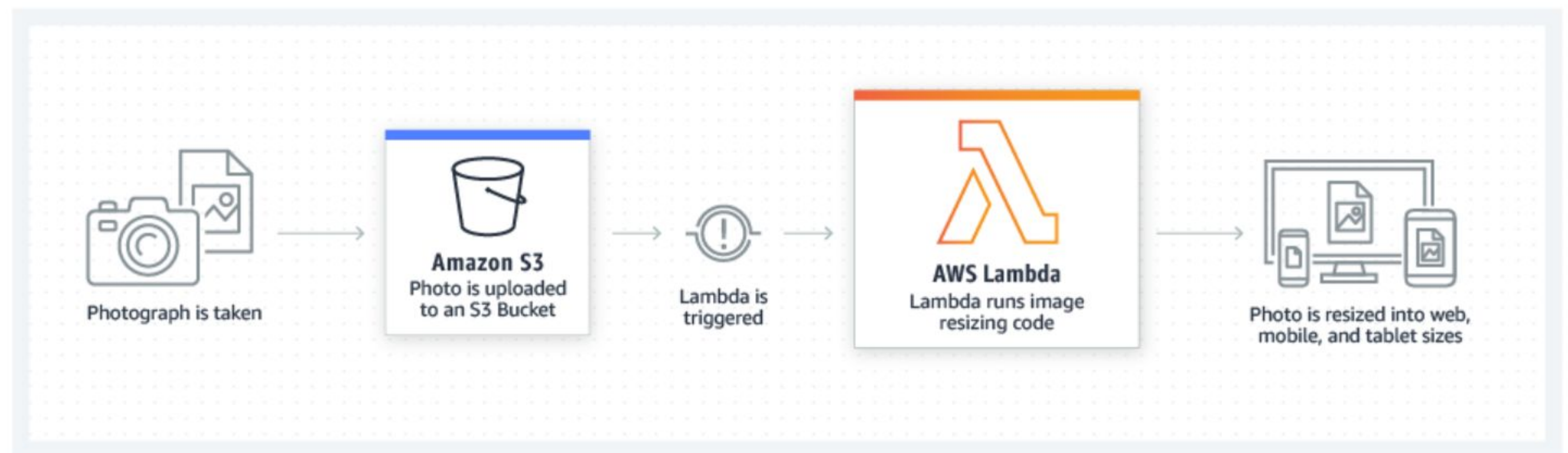




## SERVERLESS ARCHITECTURE\_

- 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



© Amazon Web Services, Inc.

### **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



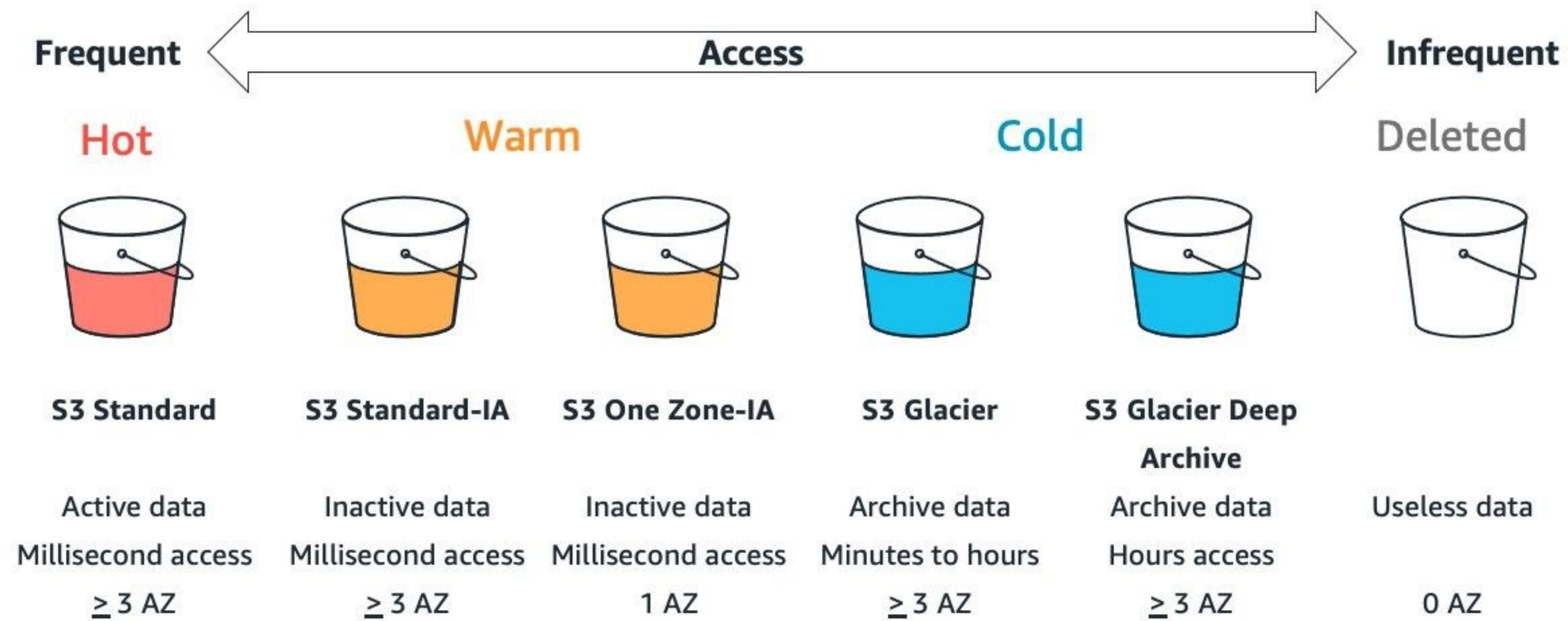
## SPOT INSTANCES

- 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) \_

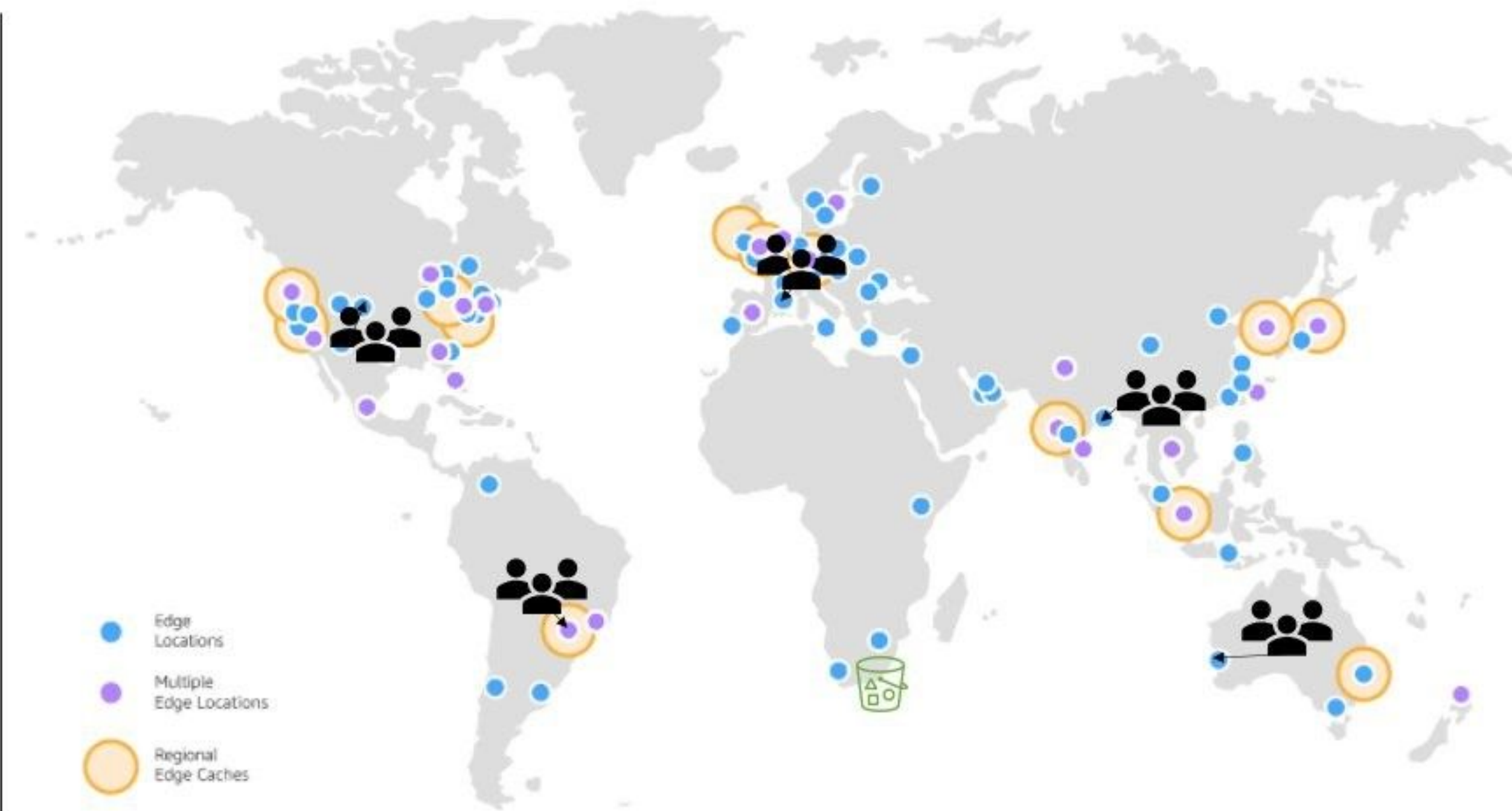
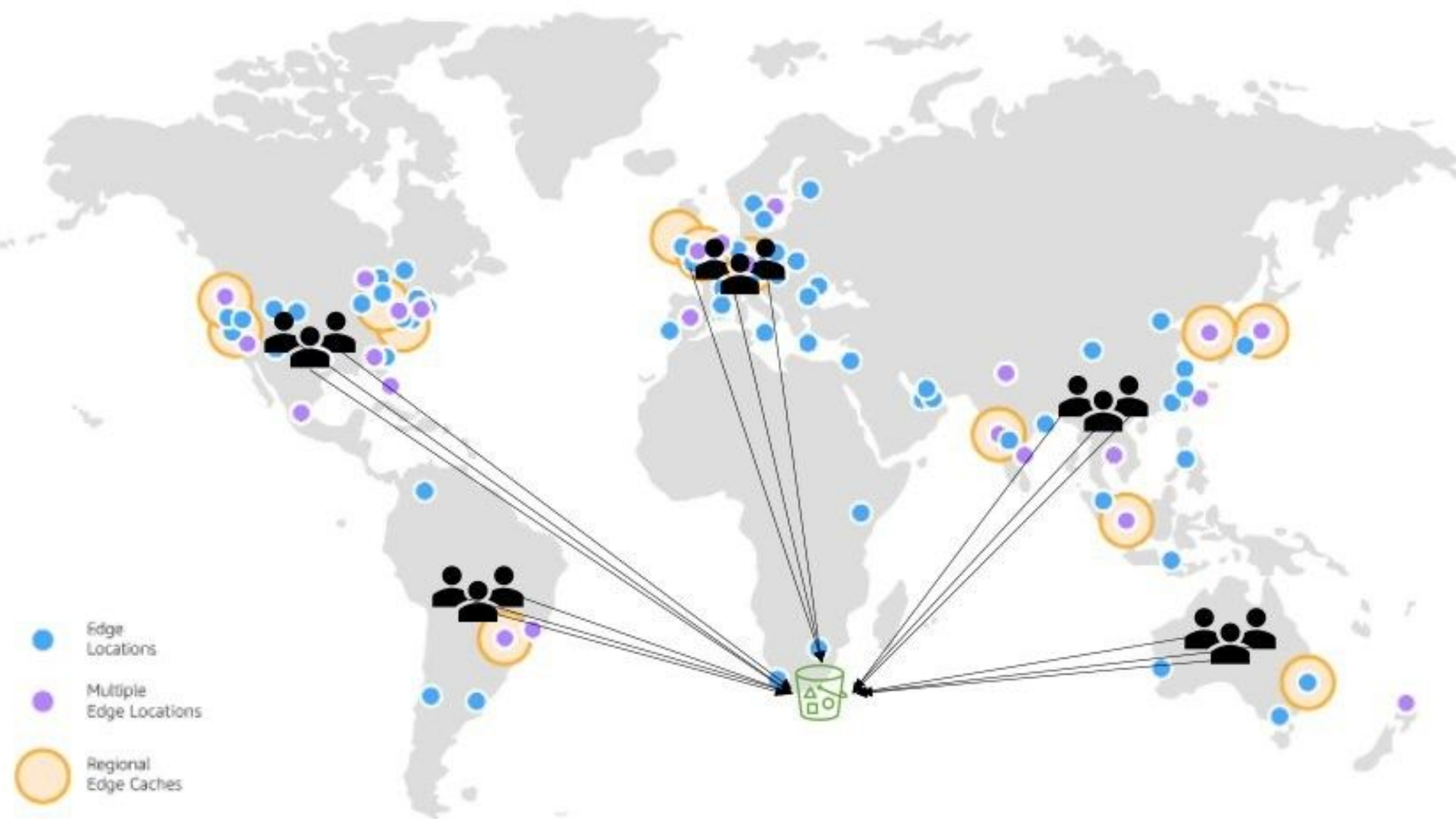




## CONTENT DELIVERY NETWORK

- 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)

► Performance Efficiency 0/8

► Cost Optimization 0/11

▼ Sustainability 0/6

SUS 1  
How do you select Regions for your workload?

SUS 2  
How do you align cloud resources to your demand?

SUS 3  
How do you take advantage of software and architecture patterns to support your sustainability goals?

SUS 4  
How do you take advantage of data management policies and patterns to support your sustainability goals?

SUS 5  
How do you select and use cloud hardware and services in your architecture to support your sustainability goals?

SUS 6  
How do your organizational processes support your sustainability goals?

Well-Architected Tool > Workloads > Test > AWS Well-Architected Framework > Review workload

## AWS Well-Architected Framework

[Add a link to your architectural design](#)

**SUS 1. How do you select Regions for your workload?** [Info](#)

[Ask an expert](#) 

The choice of Region for your workload significantly affects its KPIs, including performance, cost, and carbon footprint. To effectively improve these KPIs, you should choose Regions for your workloads based on both business requirements and sustainability goals.

☒ Question does not apply to this workload [Info](#)

Select from the following

☐ Choose Region based on both business requirements and sustainability goals [Info](#)

☐ None of these [Info](#)

► Mark best practice(s) that don't apply to this workload

**Notes - optional**

2084 characters remaining



**BOOK A WAR\_**

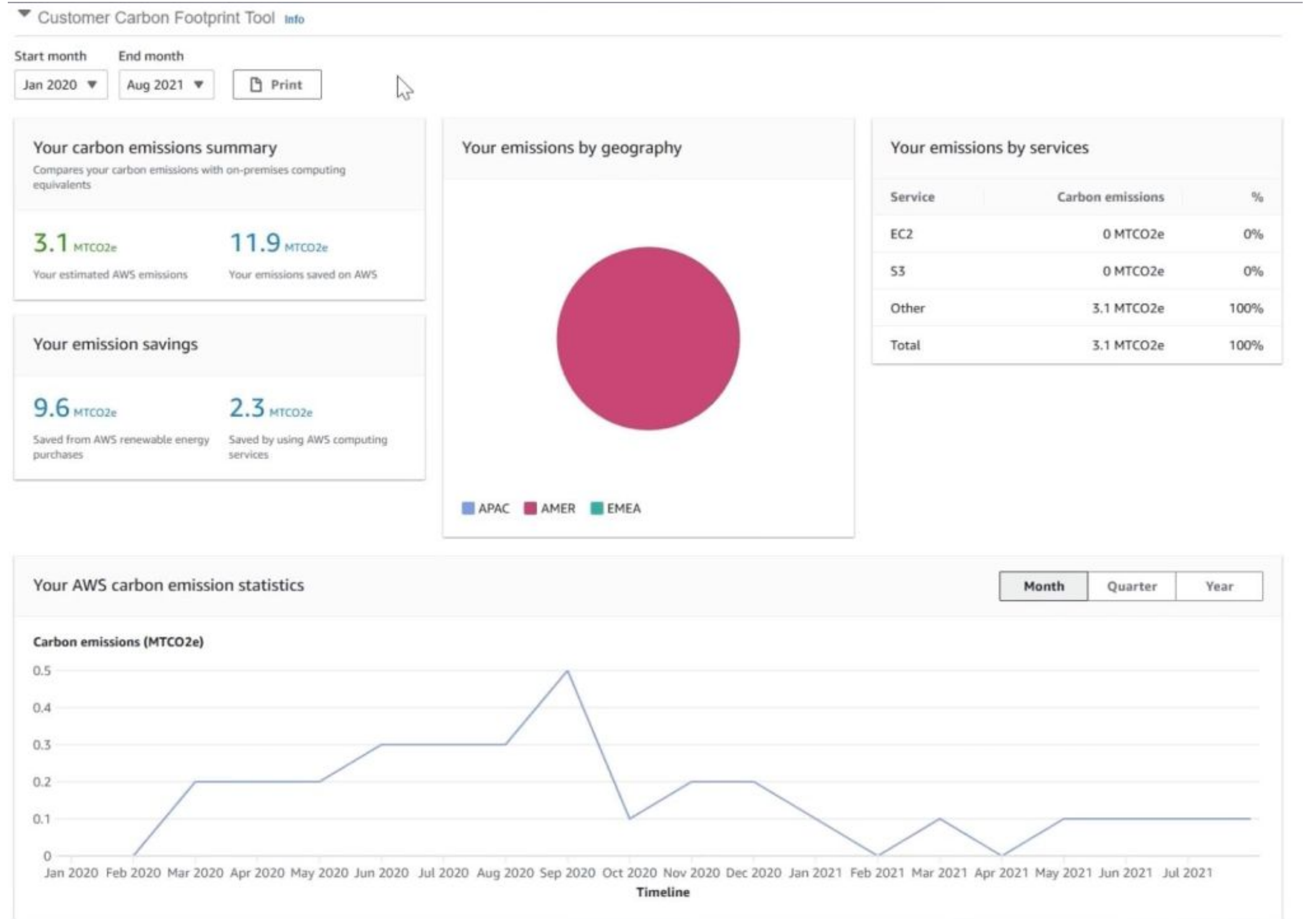
At The Scale Factory we provide **free AWS**  
**Well-Architected Reviews:**

<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? |
|---------------------------------------------------------------------------------------|--------------------------------|------------------------------------|--------------------------------|----------------------------------|---------------------------------------|-----------------------|
|    | 44.4                           | 2030 <sup>i</sup>                  | None                           | Yes                              | No                                    | Yes                   |
|   | 17.6                           | 2025                               | None                           | No                               | Yes                                   | Yes                   |
|  | 15                             | 2017                               | Ongoing <sup>ii</sup>          | No                               | Yes                                   | Yes <sup>iii</sup>    |

<sup>i</sup> 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.

<sup>ii</sup> While Google has no public deadline, it aims to power its data centers with carbon-free energy 24x7.

<sup>iii</sup> Google stated it will no longer develop custom AI/ML solutions to facilitate upstream extraction.

A decorative graphic on the left side of the slide consisting of several parallel teal diagonal stripes of varying lengths, creating a modern, geometric look.

## 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

# SOURCES AND REFERENCES

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# AWS SUSTAINABILITY TIPS

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<https://aws.amazon.com/blogs/architecture/optimizing-your-aws-infrastructure-for-sustainability-part-ii-storage/>

<https://aws.amazon.com/blogs/architecture/optimizing-your-aws-infrastructure-for-sustainability-part-iii-networking/>

<https://docs.aws.amazon.com/wellarchitected/latest/sustainability-pillar/best-practices-for-sustainability-in-the-cloud.html>

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



**THANK YOU &  
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