



EMEA HEALTHCARE & LIFE SCIENCES WORKSHOPS

Sustainability Immersion Day

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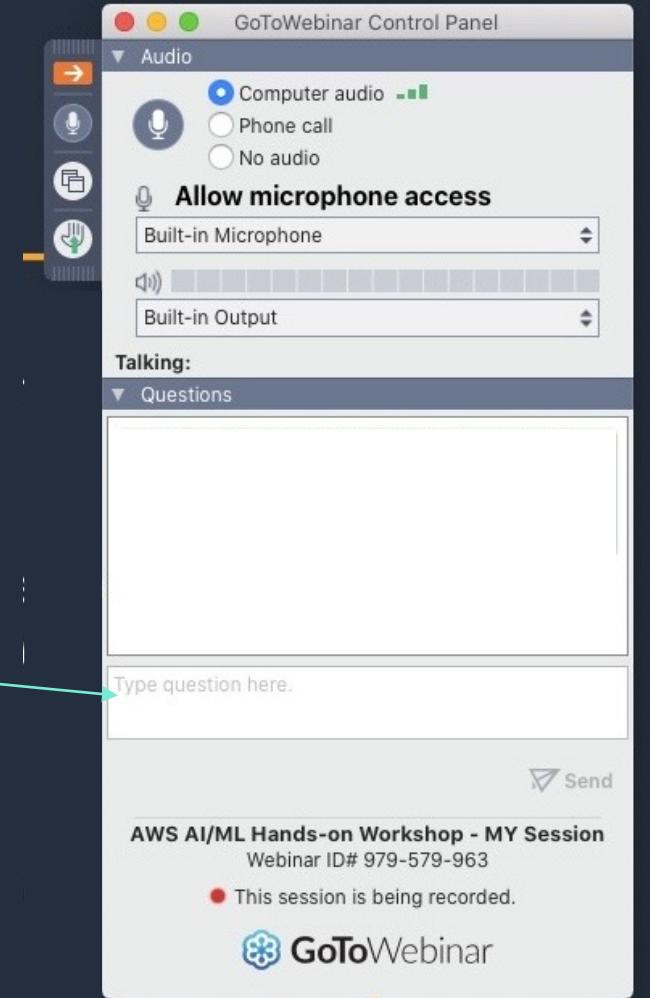
Questions & Answers

If you have any questions or encounter issues during the workshop, our support team is online.

You can submit your query in the GoToWebinar Questions function. To submit questions, select "Send"



Type your question here



Agenda

- 13:00 – 13:45 Sustainability @ AWS
- 13:45 – 15:45 Hands-On Workshop
Continuous Cost and Sustainability Optimization
- 15:45 – 17:15 Hands-On Workshop
Architecting for sustainability - Minimize data movement across networks
- 17:15 Wrap-Up and Survey

Workshop materials and instructions

- <https://catalog.us-east-1.prod.workshops.aws/workshops/7c4f8394-8081-4737-aa1b-6ae811d46e0a/en-US>
- <https://catalog.us-east-1.prod.workshops.aws/workshops/42c0fe7e-8d1c-4d5f-8b48-c818c7952242/en-US>

Your presenters today



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**Sustainability
trends are
increasing**

Customer demand

Government regulations

Employee demand

Impact investing

Sustainability as competitive positioning

Areas of sustainability Improvement



Sustainability **OF** the cloud

Delivering a sustainable IT fleet – taking advantage of the cloud and AWS efficiency through migration



Sustainability **THROUGH** the cloud

Deploying cloud-based solutions and advisory support to accelerate customer sustainability objectives



Sustainability **IN** the cloud

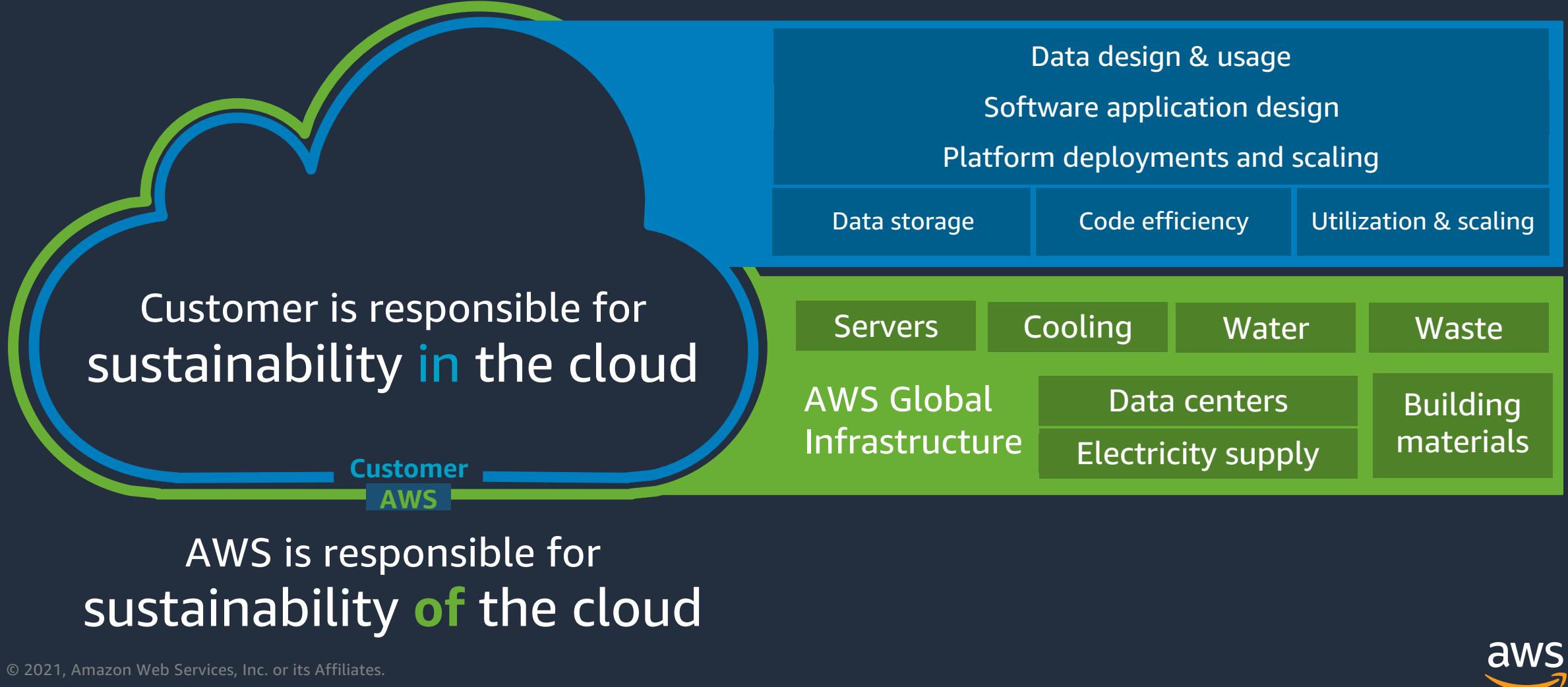
Optimizing workloads on AWS with the Sustainability pillar of the Well-Architected Framework



Sustainability OF the Cloud

Opportunity to reduce impact through migration

You share the **sustainability responsibility** with AWS



AWS journey highlights



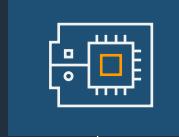
Water+ by 2030 commitment: water use efficiency and water replenishment



New data center construction incorporates use of low-carbon concrete



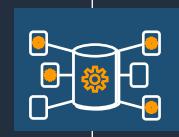
Launch of Well-Architected for Sustainability Pillar
Launch of AWS Customer Carbon Footprint Tool



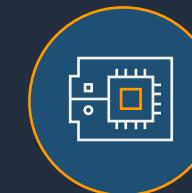
Graviton processors provide better performance per watt than any other AWS processor



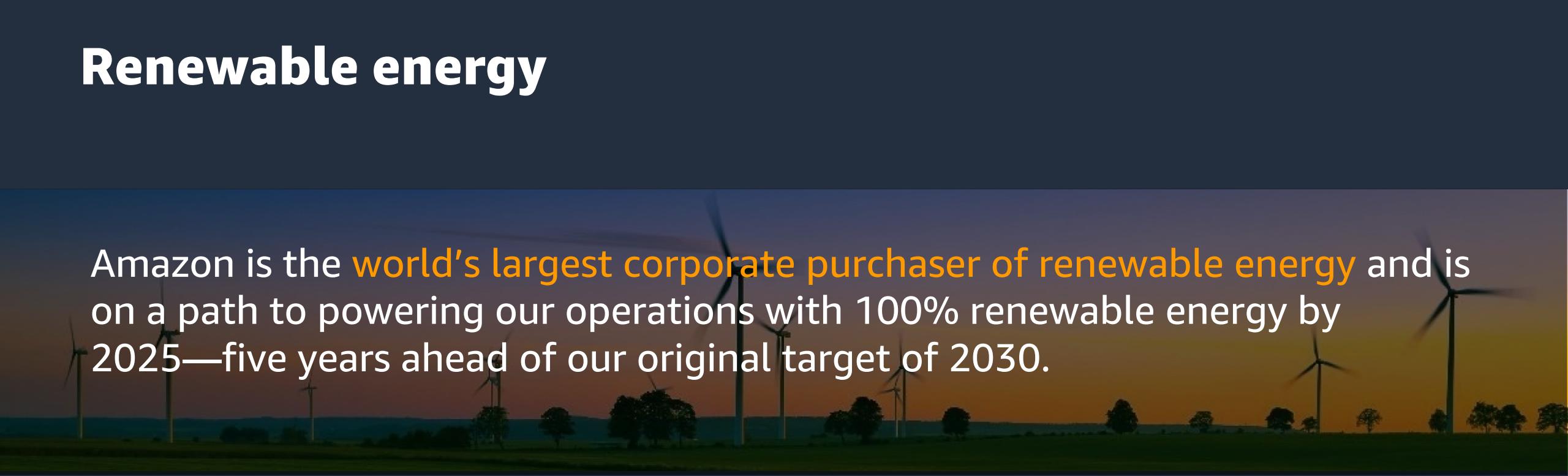
Renewable energy to power data centers



Amazon Sustainability Data Initiative (ASDI) provides free access to satellite data and climate models



Renewable energy

A photograph of a wind farm at sunset or sunrise. The sky is a gradient from dark blue to orange and yellow. Numerous wind turbines are silhouetted against the bright horizon, standing in a line across a green field. A few trees are scattered in the foreground.

Amazon is the **world's largest corporate purchaser of renewable energy** and is on a path to powering our operations with 100% renewable energy by 2025—five years ahead of our original target of 2030.

400+

Global renewable energy
projects (as of January 2023)

20+

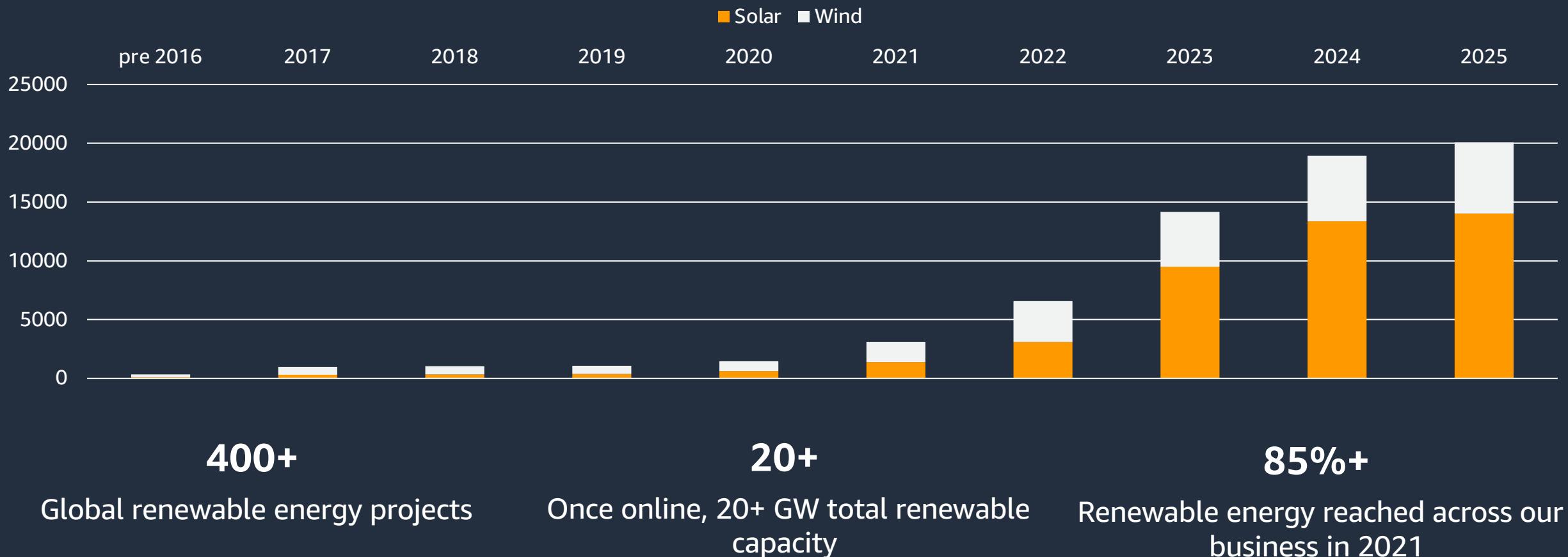
Gigawatts of total renewable
capacity (as of January 2023)

85%+

Renewable energy reached
across our business in 2021

Renewable energy

Total megawatts installed by year, as of January 2023.



Carbon reduction opportunity

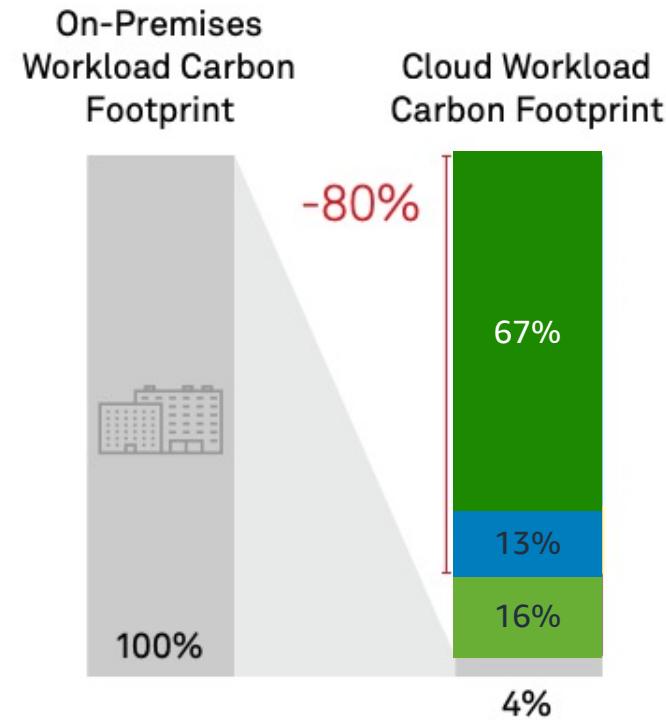
AWS can lower the workload carbon footprint of average on-premises data centers by nearly 80% today and up to 96% once AWS is powered with 100% renewable energy



Find all the reports on aws.amazon.com/sustainability/resources/

Europe: Carbon reduction opportunity

AWS up to 5 times more energy efficient than typical EU enterprise infrastructure



Efficiency from Chip to Grid

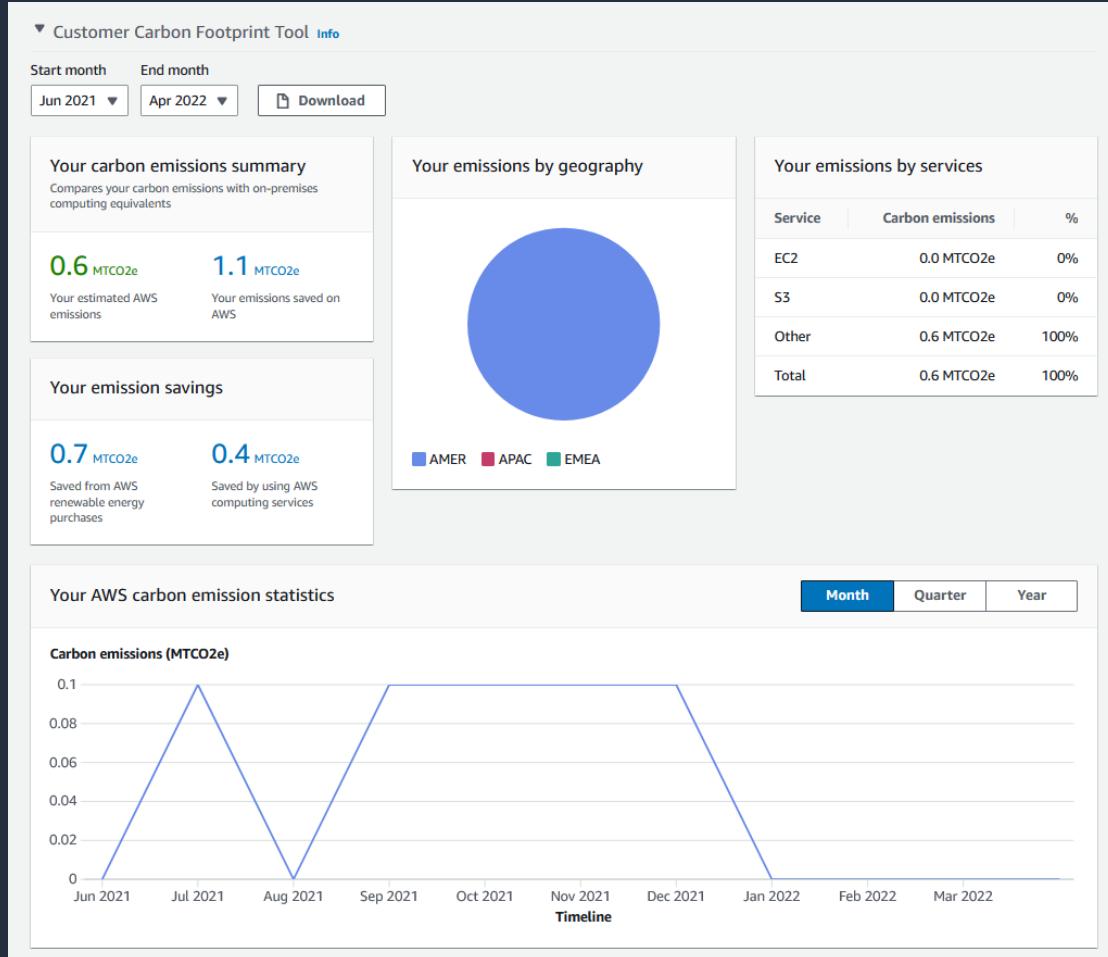
Source: 451 Research, a part of S&P Global Market Intelligence,
Saving Energy in Europe by Using Amazon Web Services, 2021

Cloud servers are responsible for the largest energy reduction, more than 67%, due to being more energy-efficient and more highly utilized

AWS data center facilities account for another 13% reduction by using power and cooling systems that are more efficient, bringing energy savings to 80%

As AWS continues to increase its renewable energy globally, that could further reduce the carbon footprint of workloads moved to cloud by up to 16%

AWS customer carbon footprint tool



Calculate carbon emissions generated from your AWS workloads

Understand historical carbon footprint and review changes in emissions over time

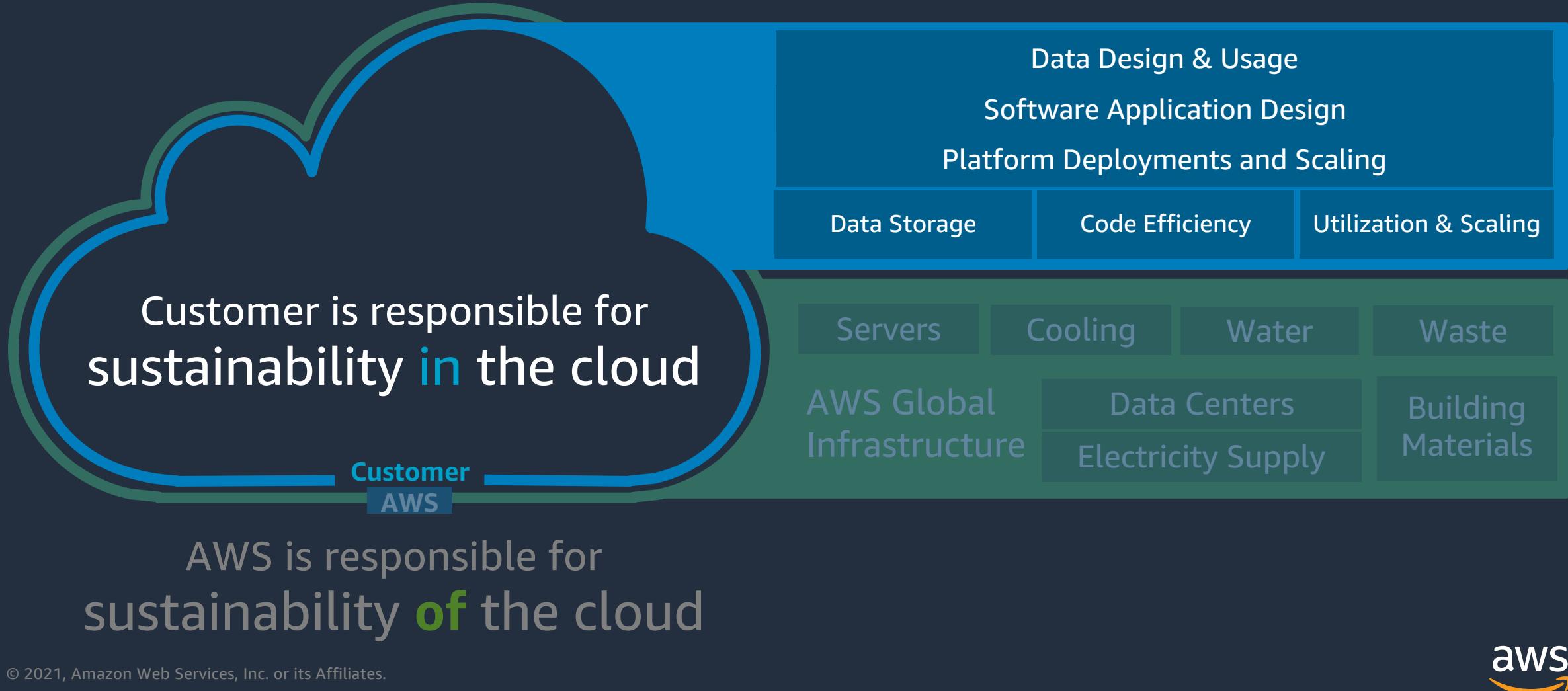
Forecast changes as Amazon stays on a path to 100% renewable energy by 2025



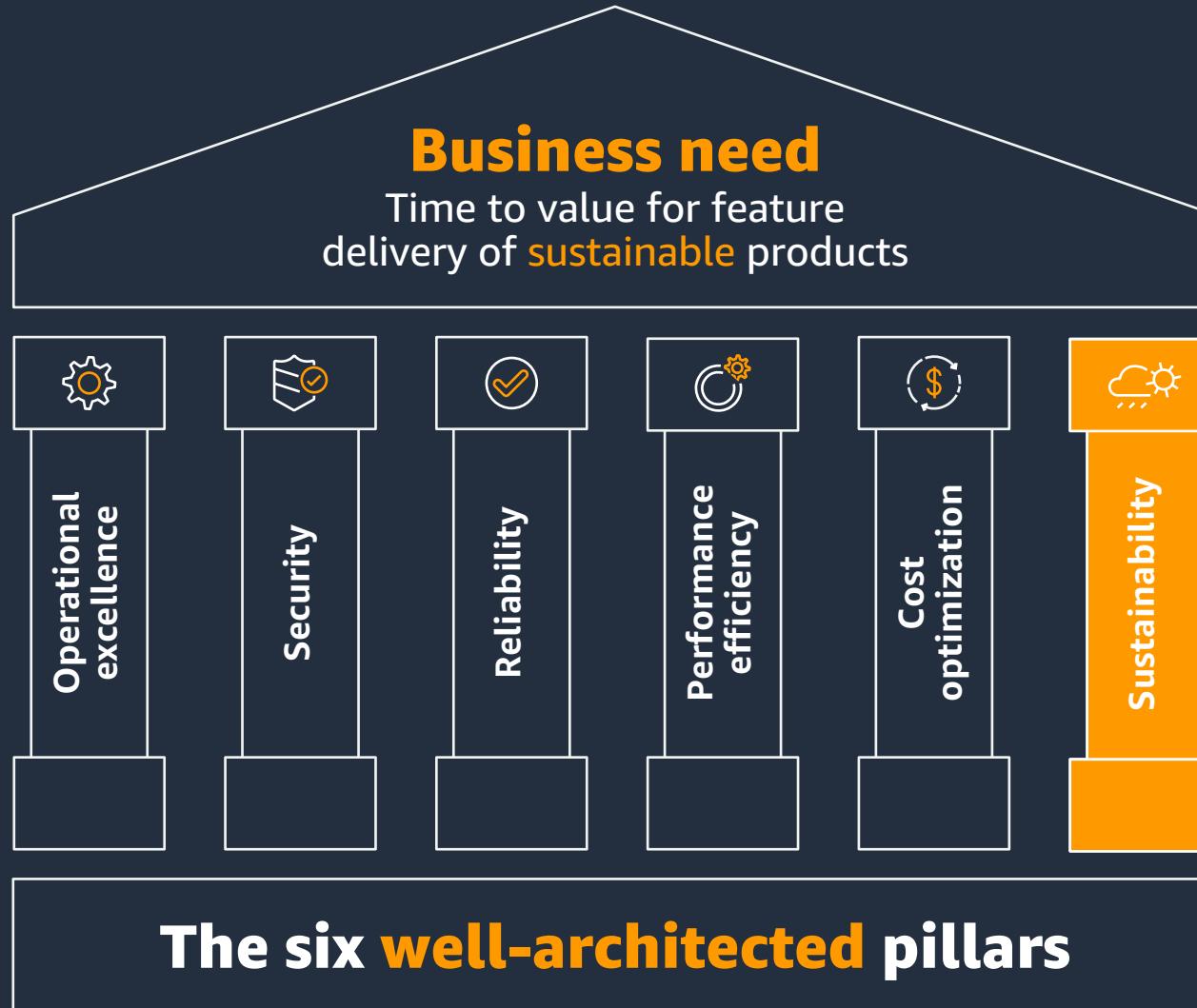
Sustainability IN the cloud

**Using AWS Services in a sustainable way
Sustainably Pillar of the Well-Architected Framework
customer carbon footprint tool**

The sustainability responsibility in the cloud



Sustainability pillar of the Well-Architected Framework



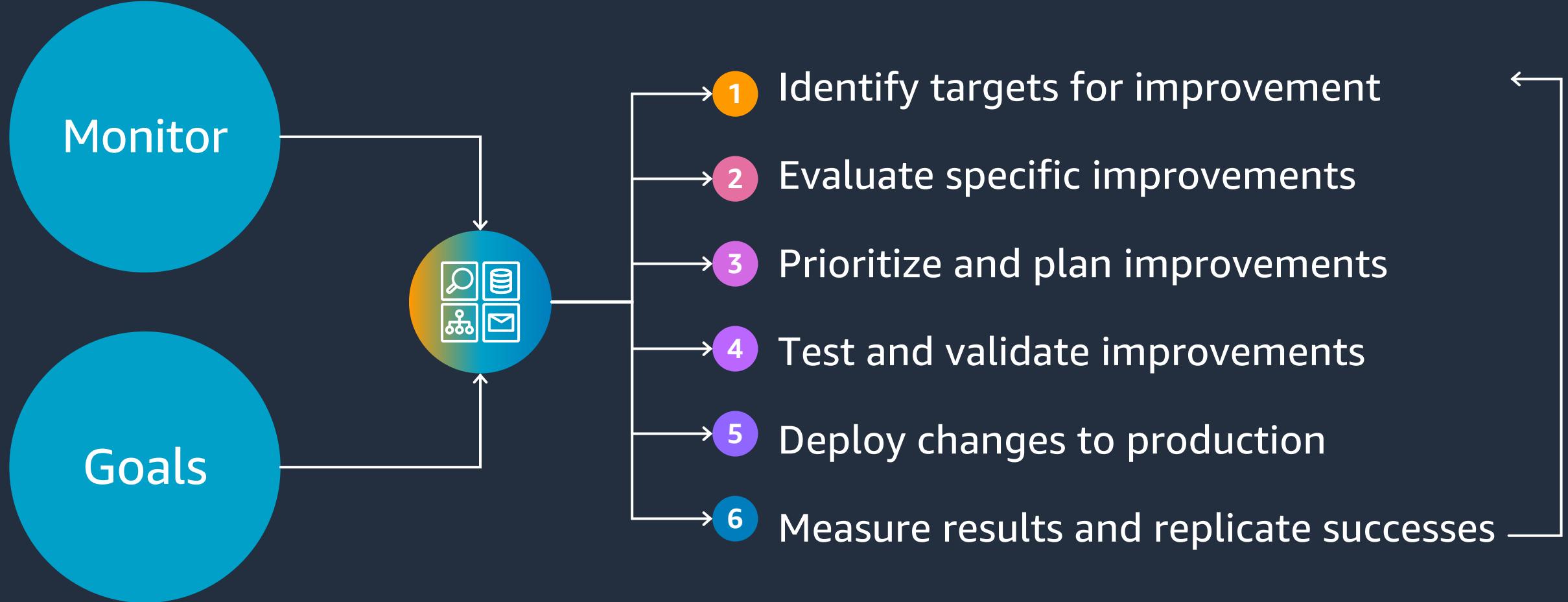
AWS Well-Architected pillar for sustainability



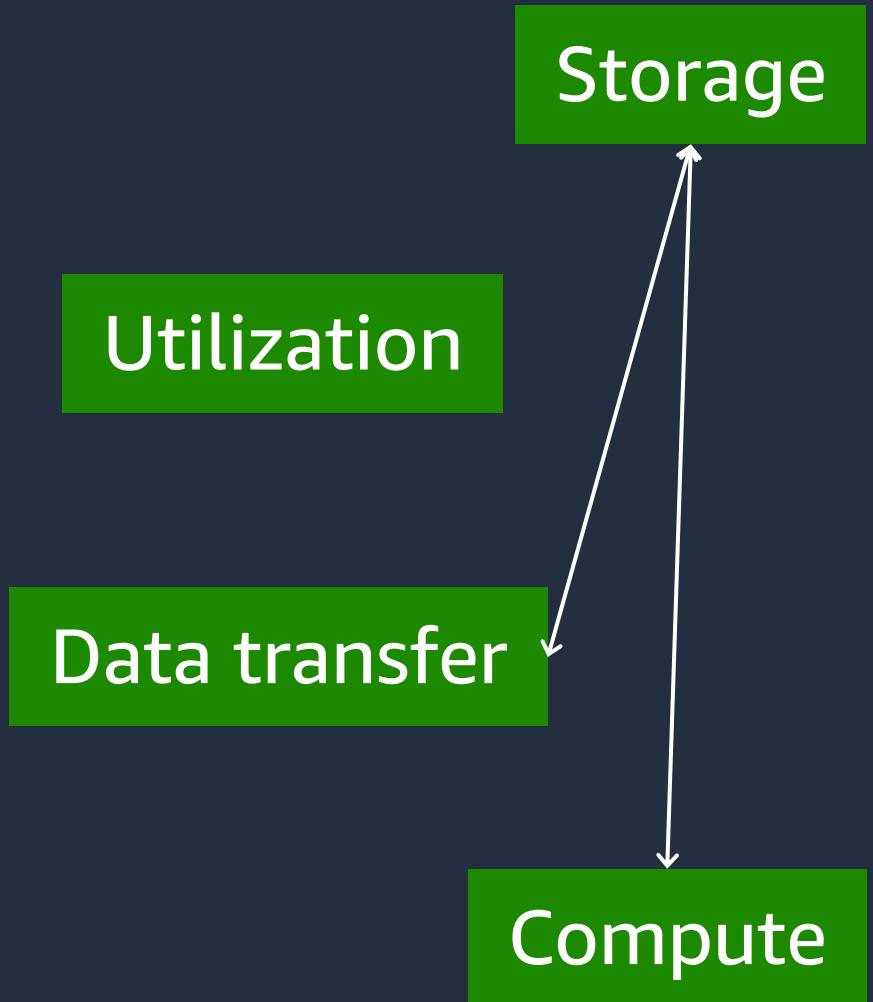
- **Understand** environmental impacts of the services used
- **Quantify** impacts through the entire workload lifecycle
- **Apply** best practices to reduce these impacts

Sustainability in the cloud is
a continuous, focused effort on
energy reduction and **efficiency**
across all components of a workload

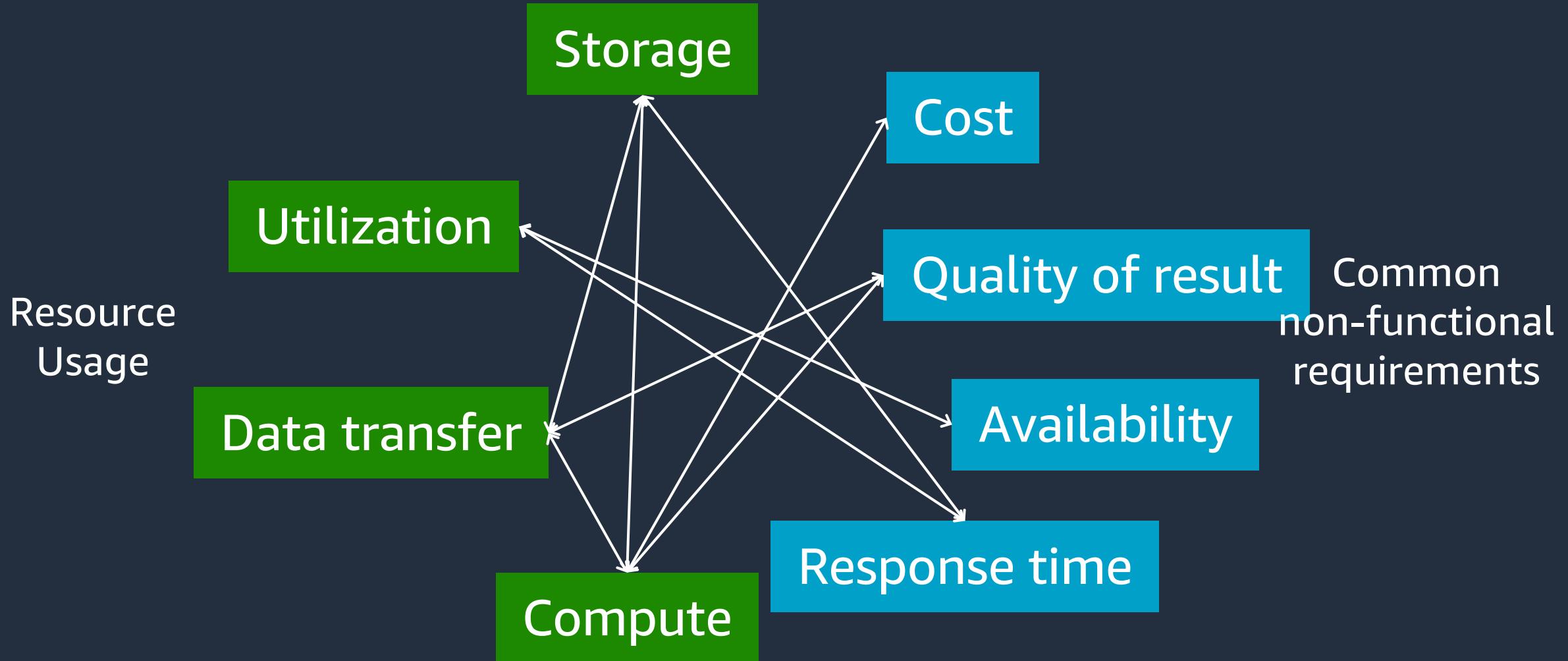
Improvement process



Understand your impact through metrics



Sustainability is a non-functional requirement

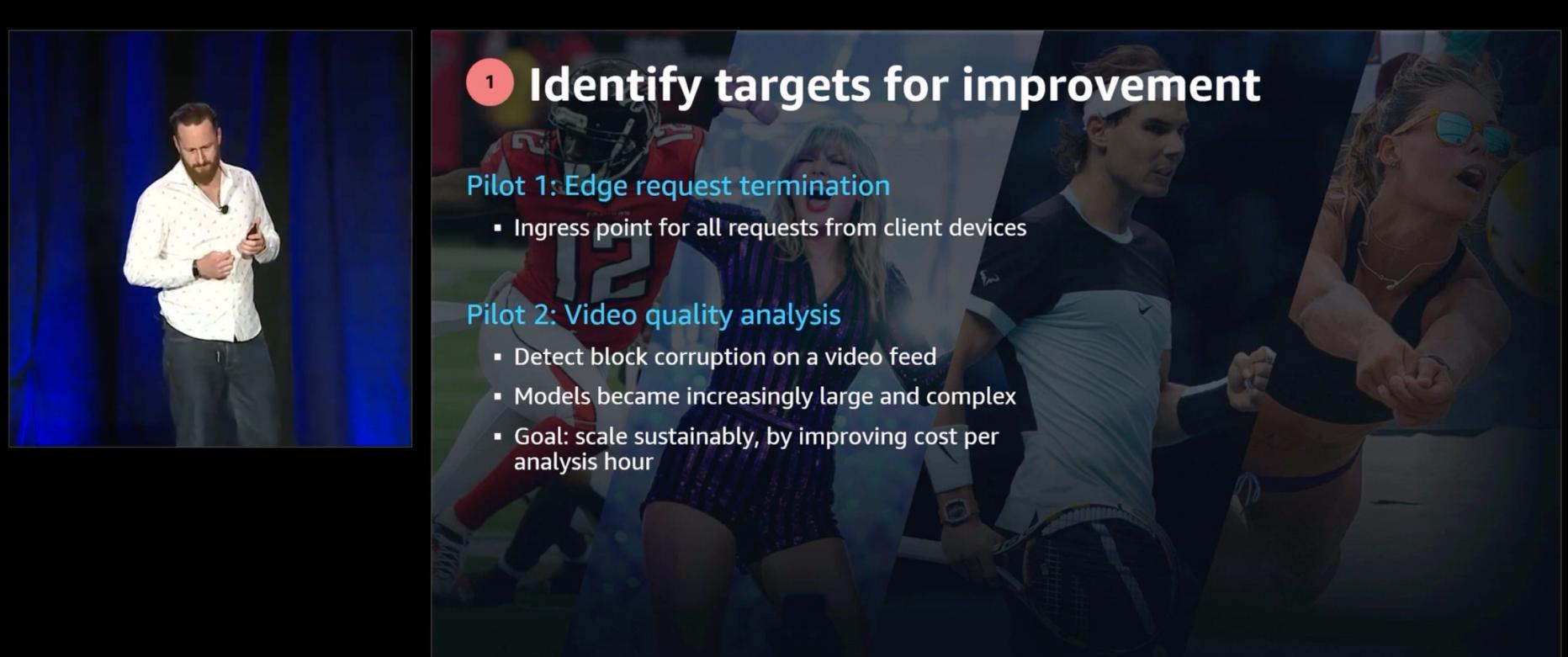


Resources

Unit of work

Normalize sustainability KPIs to make them comparable

Improvement process: Prime Video



A composite image showing a speaker on stage on the left and a presentation slide on the right. The slide has a dark background with a collage of sports images (football, tennis, swimming) in the background. The title '1 Identify targets for improvement' is at the top, followed by two sections: 'Pilot 1: Edge request termination' and 'Pilot 2: Video quality analysis', each with a bulleted list of goals.

1 Identify targets for improvement

Pilot 1: Edge request termination

- Ingress point for all requests from client devices

Pilot 2: Video quality analysis

- Detect block corruption on a video feed
- Models became increasingly large and complex
- Goal: scale sustainably, by improving cost per analysis hour

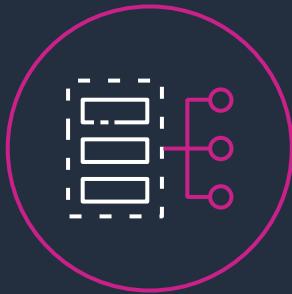


bit.ly/AWSPrimeVideo

Focus domains of the Sustainability pillar



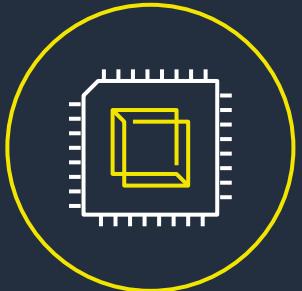
Region
selection



Alignment to
demand



Data



Hardware &
services

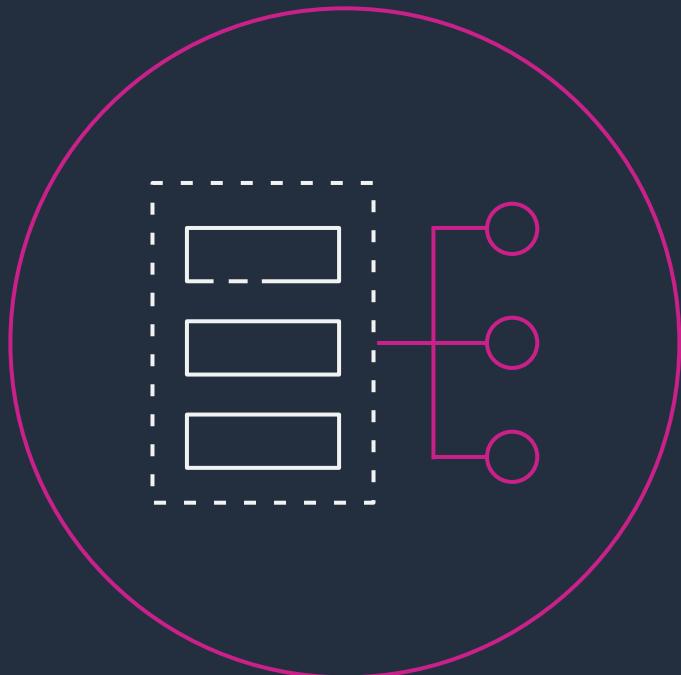


Software &
architecture



Process & culture

Alignment to demand



Scale infrastructure with user load

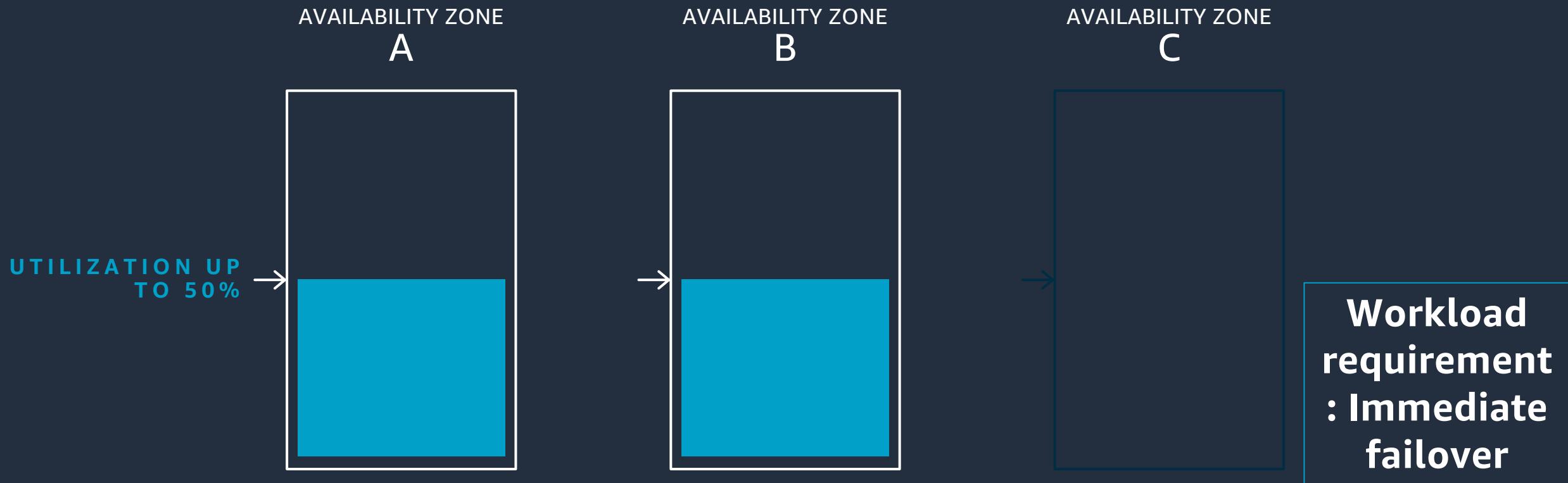
Align service level agreements (SLAs) with sustainability goals

Eliminate the creation and maintenance of unused assets

Optimize the geographic placement of your workloads for user locations

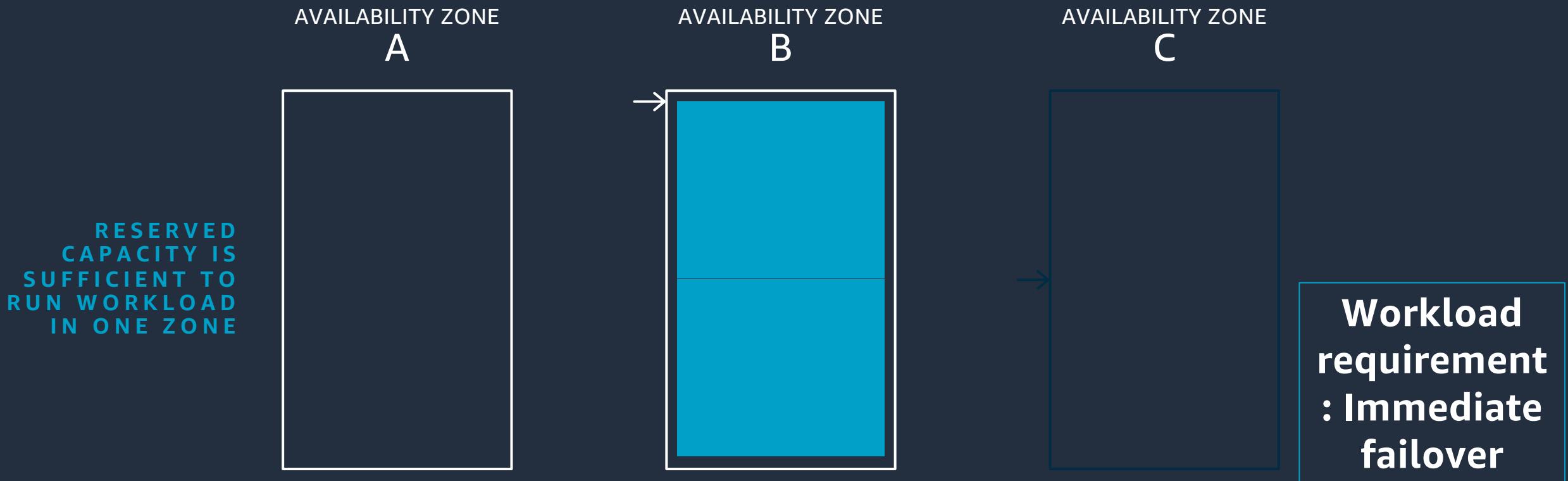
Optimize team member resources for the activities performed

Optimize capacity for sustainability



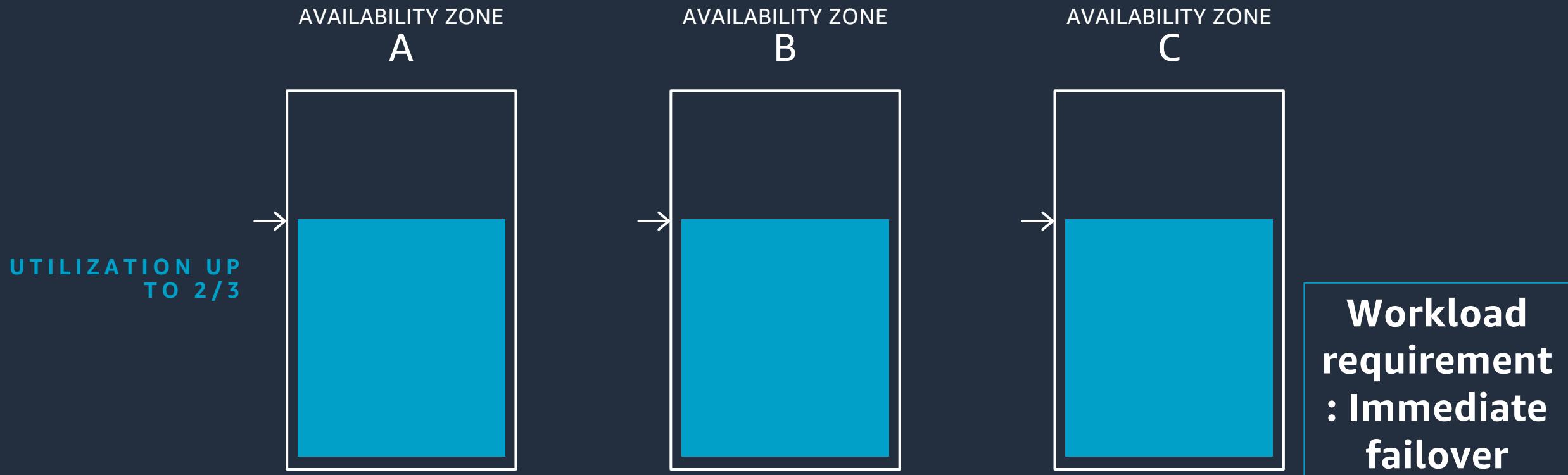
Running in two zones you need to reserve enough spare capacity to rapidly switch the load for resilience

Optimize capacity for sustainability



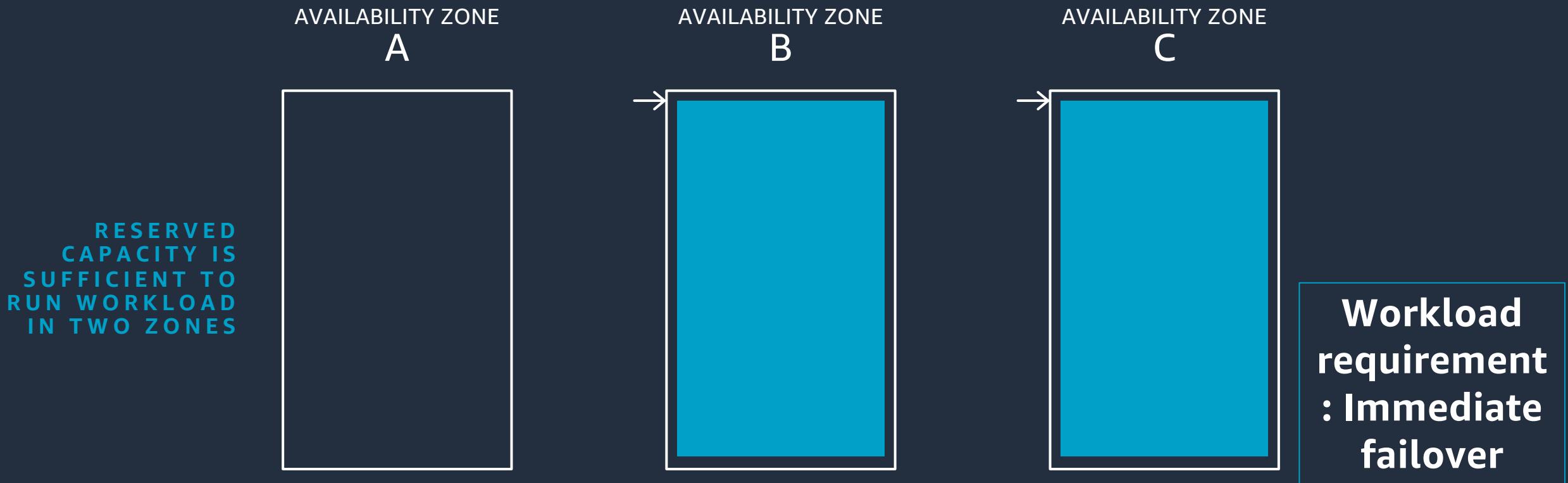
Running in two zones you need to reserve enough spare capacity to rapidly switch the load for resilience

Optimize capacity for sustainability



Running in three zones you need less reserved capacity to switch the load

Optimize capacity for sustainability



Split the extra load over two zones;
higher average utilization, lower cost and lower impact

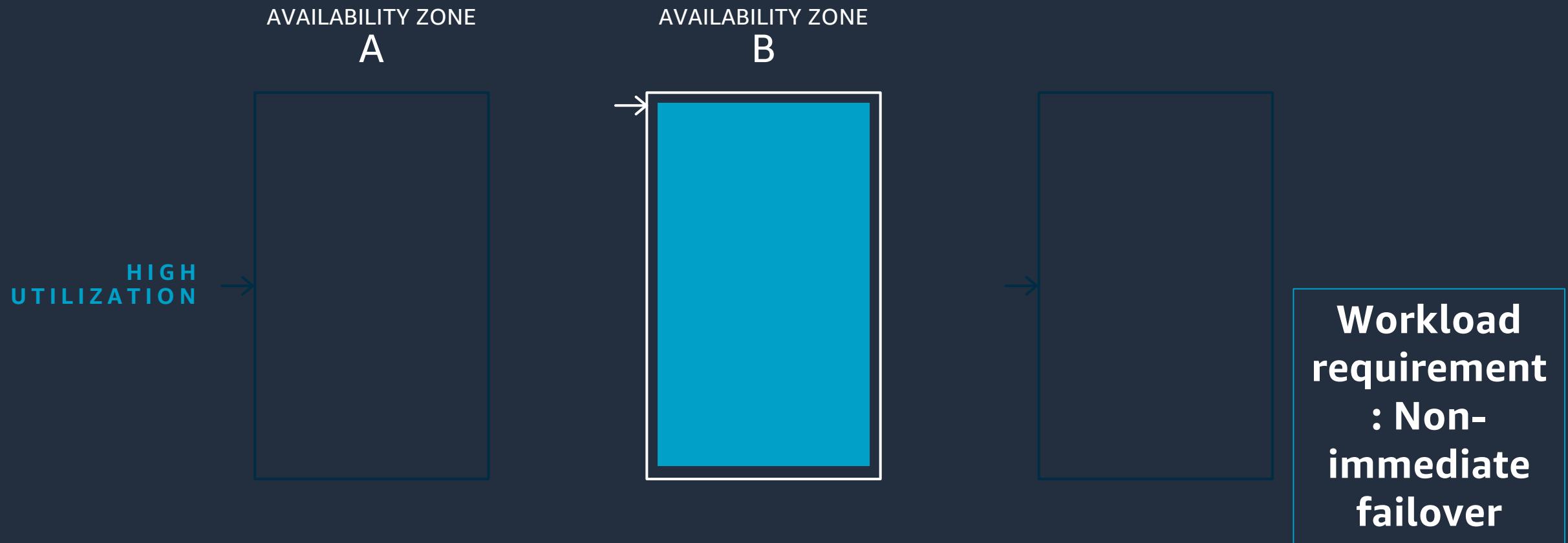
Optimize resilience for sustainability



Trade-off for cost and impact

Use cold capacity for failover;
increased time to respond to failover request

Optimize resilience for sustainability

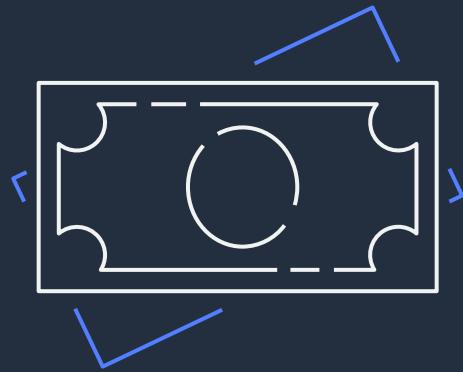


Trade-off for cost and impact

Use on-demand cold capacity for failover;
increased time to respond to failover request

Architectural recommendation

NEGOTIATE IMPACT-FRIENDLY SLAS



May
reduce cost

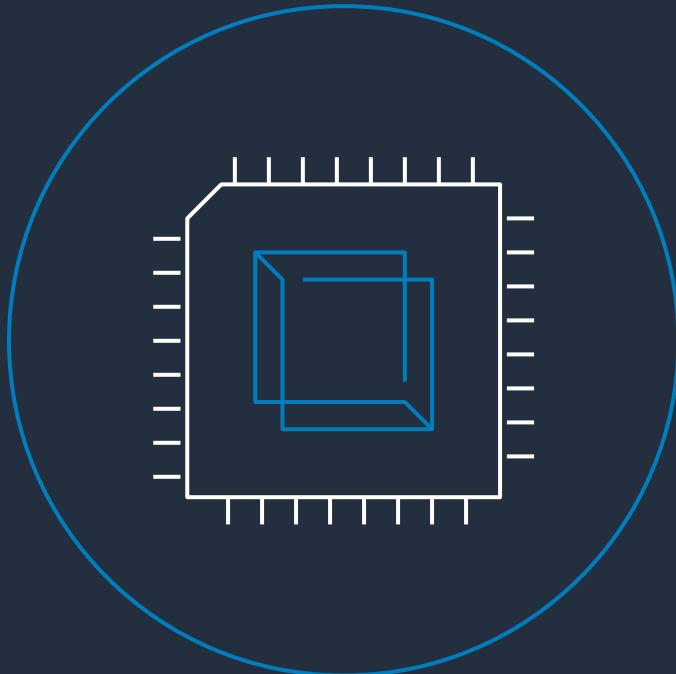


Small increase
in response time



Reduction in
overall impact

Hardware patterns



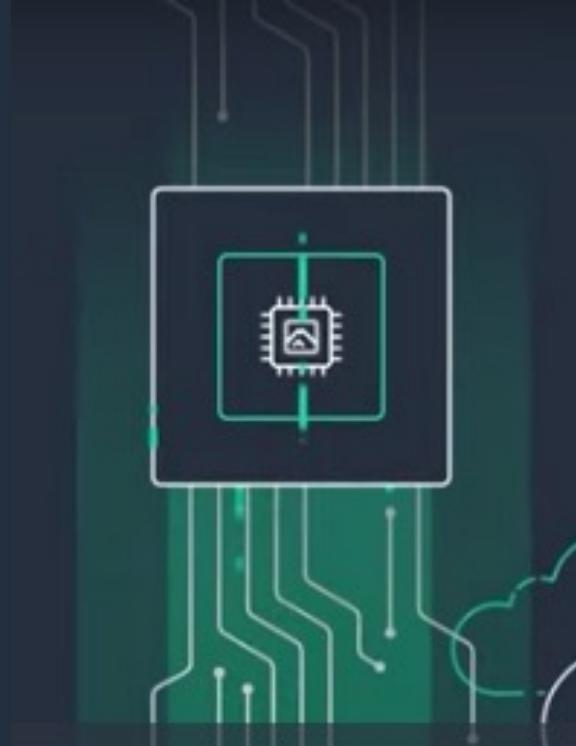
Use the minimum amount of hardware to meet your needs

Use the instance types that meet your requirements with the least impact

Use managed services

Optimize your use of GPUs

AWS Graviton, Inferentia, and Trainium

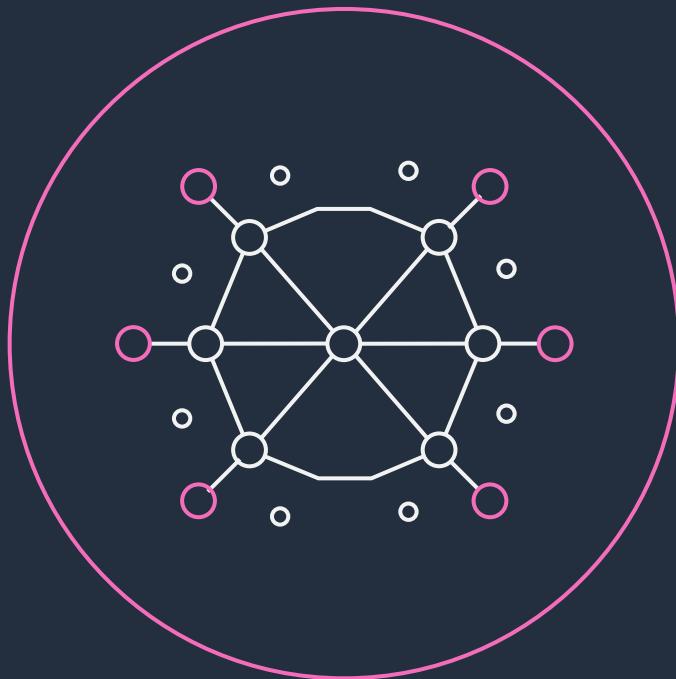


The latest generation of AWS-designed processors built for the cloud

Graviton3-based Amazon EC2 instances **use up to 60% less energy for the same performance** than comparable instances

Inferentia instances consume **54% less power** than comparable EC2 instances

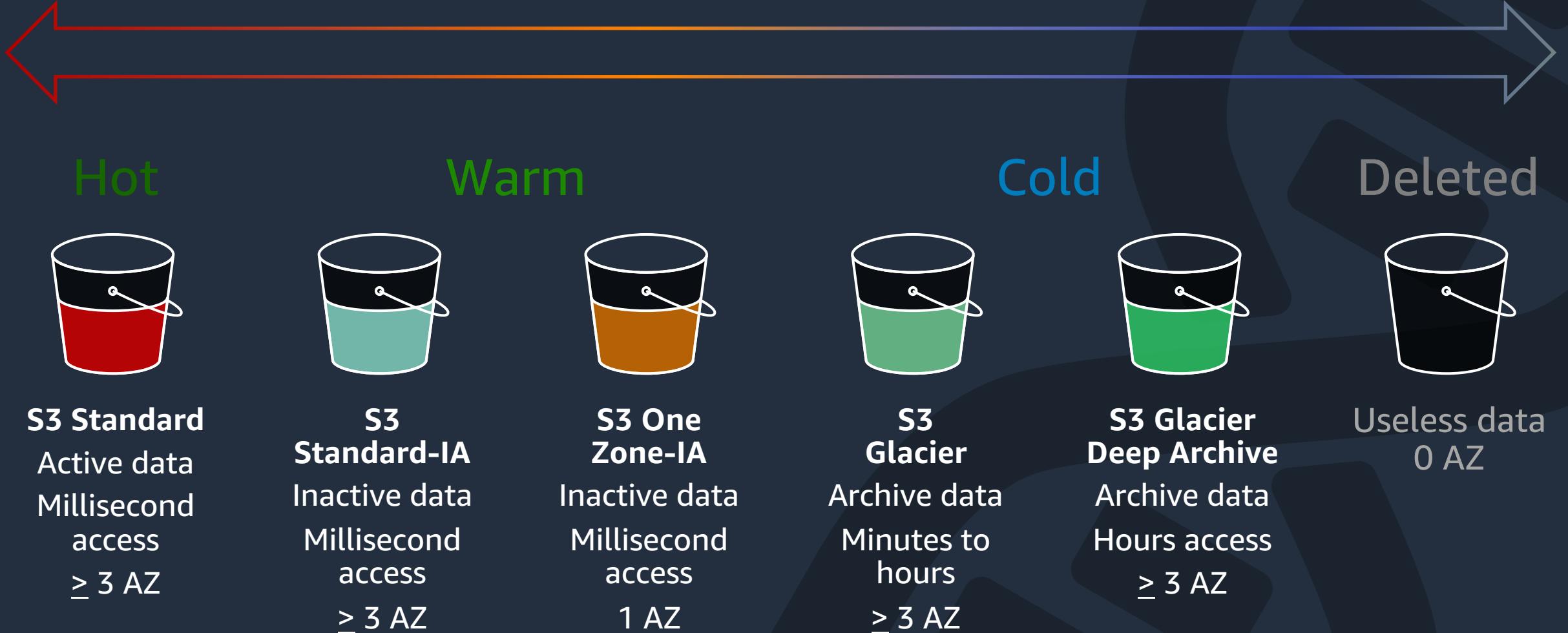
Data patterns



- Implement a data classification policy
- Use technologies that best support your data access and storage patterns
- Use lifecycle policies to automatically delete unnecessary data
- Minimize overprovisioning in block storage
- Remove unneeded or redundant data
- Use shared file systems or object storage to access common data
- Minimize data movement across networks
- Only backup data when it would be more impactful, or impossible, to recreate

Pick a lower impact storage class

Use Intelligent Tiering to optimize for you – Example Amazon S3:



Optimize log storage

Large amount of logs stored and archived to Amazon S3

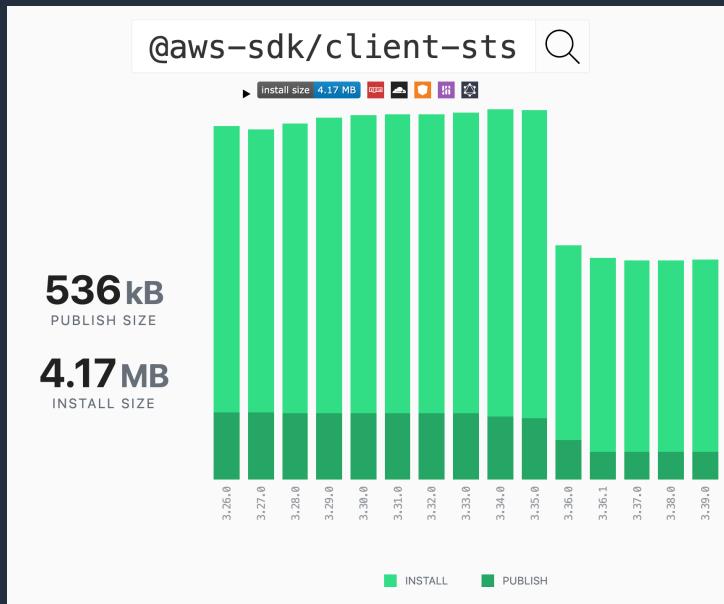
Switched compression algorithm to ZSTD

Compression ratio **improved by 30%** from gzip to ZSTD

Compression ratio improved from 1:7 for LZ4 to
1:15 for ZSTD

Reduced storage by approximately **1 Exabyte**

Reduce build artifact size



AWS SDK for JavaScript is used by browsers and npm applications to consume AWS services

Version 3 introduced modular packages per service client

Team gathered early feedback from the community

Reduced size in iterations

Modular packaging allows **reduction of bundle size by ~75%**

Further optimization **reduced install & publish size by ~50%**

Energy used per programming language

<https://aws.amazon.com/blogsopensource/sustainability-with-rust/>

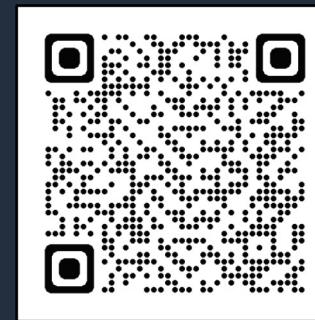


Table 4. Normalized global results for Energy, Time, and Memory

Total			
	Energy	Time	Mb
(c) C	1.00	1.00	1.00
(c) Rust	1.03	1.04	1.05
(c) C++	1.34	1.56	1.17
(c) Ada	1.70	1.85	1.24
(v) Java	1.98	1.89	1.34
(c) Pascal	2.14	2.14	1.47
(c) Chapel	2.18	2.83	1.54
(v) Lisp	2.27	3.02	1.92
(c) Ocaml	2.40	3.09	2.45
(c) Fortran	2.52	3.14	2.57
(c) Swift	2.79	3.40	2.71
(c) Haskell	3.10	3.55	2.80
(v) C#	3.14	4.20	2.82
(c) Go	3.23	4.20	2.85
(i) Dart	3.83	6.30	3.34
(v) F#	4.13	6.52	3.52
(i) JavaScript	4.45	6.67	3.97
(v) Racket	7.91	11.27	4.00
(i) TypeScript	21.50	26.99	4.25
(i) Hack	24.02	27.64	4.59
(i) PHP	29.30	36.71	4.69
(v) Erlang	42.23	43.44	6.01
(i) Lua	45.98	46.20	6.62
(i) Jruby	46.54	59.34	6.72
(i) Ruby	69.91	65.79	7.20
(i) Python	75.88	71.90	8.64
(i) Perl	79.58	82.91	19.84

Selected Recommendation Tooling along the WA Pillar



AWS Trusted Advisor



AWS Cost Management



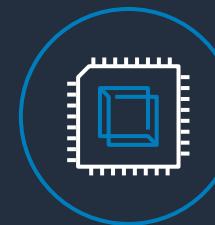
Alignment to Demand



Software & Architecture



Data



Hardware & Services



Process & Culture



Service Lens &
AWS X-Ray



Storage
Lens



Amazon
CodeGuru



AWS Compute
Optimizer

Development

- Optimize code
- Choose faster languages and runtimes
- Efficient algorithms
- Faster implementations
- Reduce logging
- Reduce retries and work amplification

Operations

- Higher utilization
- Automation
- Relax over-specified requirements
- Archive and delete data sooner
- Deduplicate data
- Choose times and locations carefully

Make sure the savings are big enough to justify the work!



Sustainability **THROUGH** the Cloud

**AWS enables sustainability transformation
Access and leverage sustainability data**

Sustainability solutions are powered by data

Data is diverse, growing exponentially, and used by many applications
AWS storage and analytics services and data programs can help

**Open Data
Sponsorship
Program**

**Amazon Sustainability
Data Initiative (ASDI)**

**AWS Data
Exchange**

Image from Landsat 8 satellite, courtesy of the U.S. Geological Survey



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CALL TO ACTION FOR AWS BUILDERS



Ask questions about sustainability in planning discussions and set goals



Find areas where there is the biggest opportunity to make a difference



Collect and share your sustainability optimization learnings

Access your AWS account – Part 1

- Go to: catalog.workshops.aws/join
- Access code:
6f5e-007491-86



Sign in
Choose a preferred sign-in method

Email one-time password (OTP)

Enter your personal or corporate email to receive a one-time password

Login with Amazon

Login with your Amazon.com retail account

Amazon employee

Login with your Amazon Corporate account. Only for Amazon Employees.

A screenshot of the AWS Sign In page. The 'Email one-time password (OTP)' button is highlighted with a red box, indicating it is the recommended method for this workshop. The other options (Login with Amazon and Amazon employee) are shown below it.



WELL ARCHITECTED FRAMEWORK: LAB

Architecting for sustainability

Minimize data movement across
networks

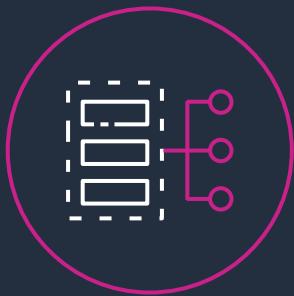
Level: 200

Duration: 1,5 ~ 2 hours

Focus domains of the Sustainability pillar



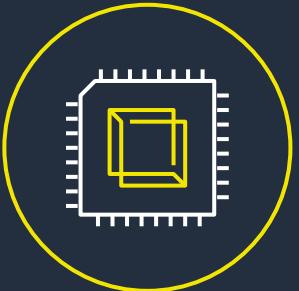
Region selection



Alignment to demand



Data



Hardware & services

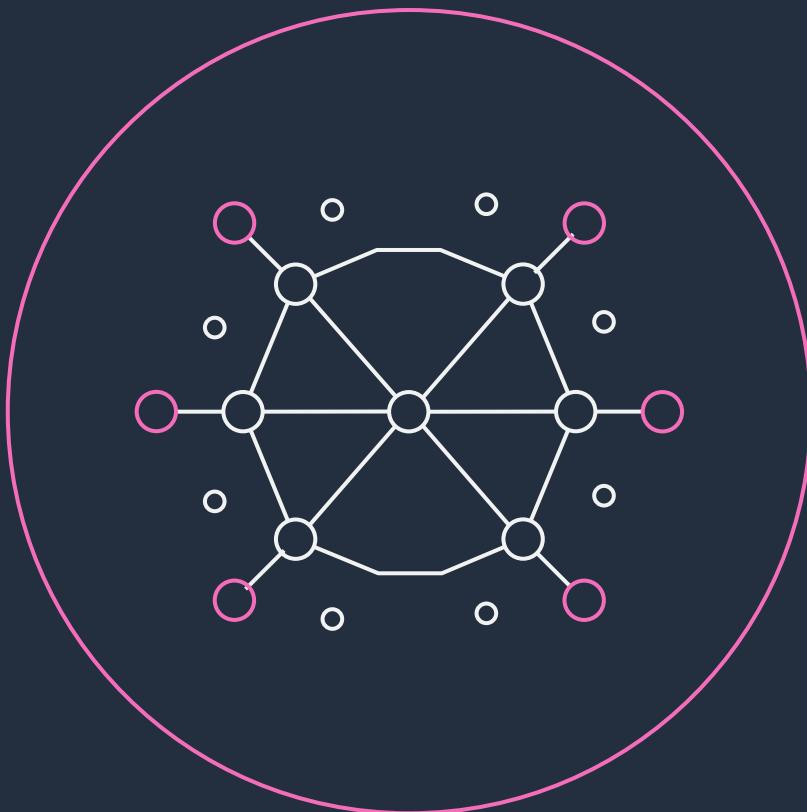


Software & architecture



Process & culture

Data patterns



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Use technologies that best support your data access and storage patterns

Use lifecycle policies to automatically delete unnecessary data

Minimize overprovisioning in block storage

Remove unneeded or redundant data

Use shared file systems or object storage to access common data

Minimize data movement across networks

Only backup data when it would be more impactful, or impossible, to recreate

“Globally, data transmission networks consumed 260-340 TWh in 2021, or 1.1-1.4% of global electricity use.”

International Energy Agency
Data Centres and Data Transmission Networks Report, 2022



Help Out Office Dog Leasing

The vision: bringing wagging tails and slobbery kisses to workplaces

- They run a website for office dog bookings on AWS
- Office Dog Leasing has committed to become a more sustainable
- Their cloud architecture needs to be more resource efficient



YOUR Task:

Measure and reduce data movement!



Goals of the lab



Resources

Unit of work

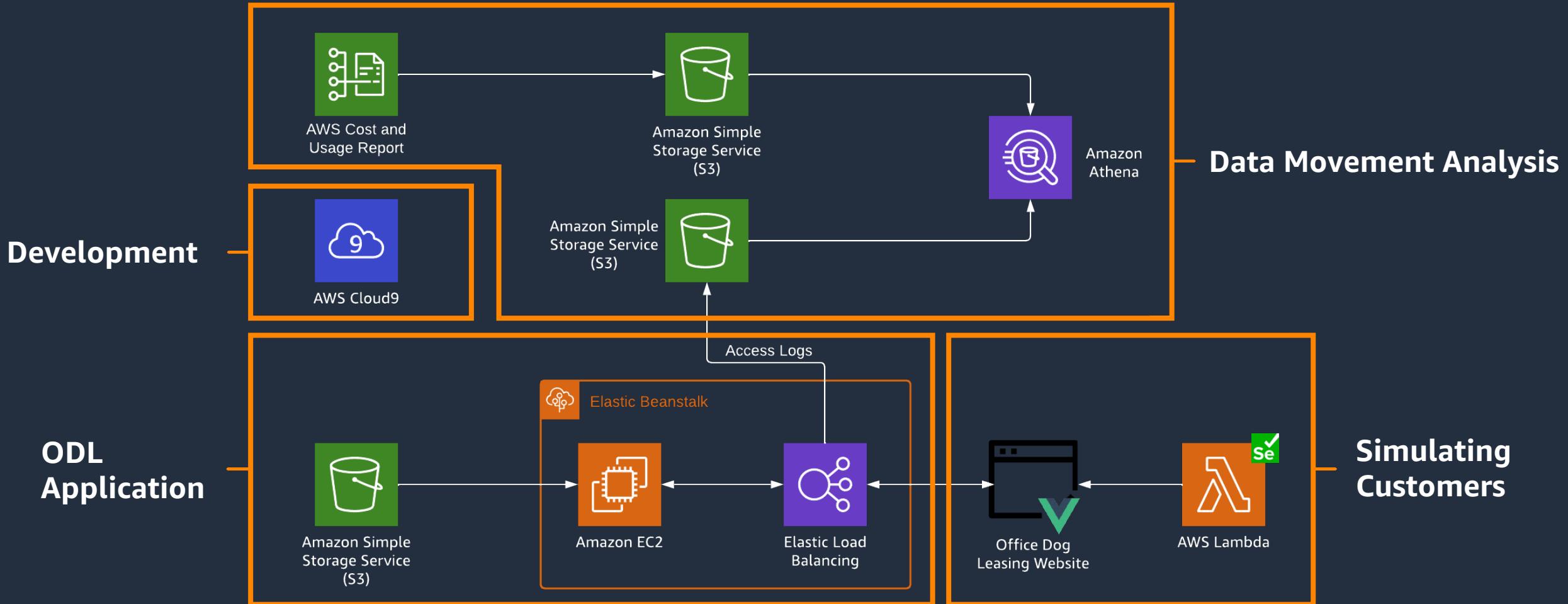
Understand what services to use to find out about the data movement of your architecture

Know how to calculate key performance indicator (KPI) with the help of sustainability proxy metrics to measure your data movement

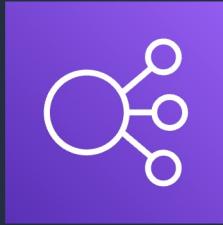


Apply the approach of reducing data movement to an example architecture

Architecture of the example application



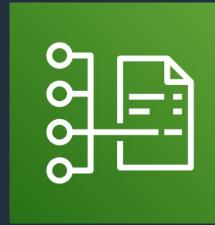
Important Services



Elastic Load Balancing

Distribute network traffic to improve application and appliance scalability

- Provides access logs that capture detailed information about requests sent to your load balancer
- These access logs can be used to analyze traffic patterns and troubleshoot issues



Cost & Usage Report

Contains the most comprehensive set of cost and usage data available

- Can be used to receive data about AWS usage, including detailed information about the data transfer
- Information about different types of data transfer can be analyzed for traffic patterns

Workshop Flow

1. Setup the example application
2. Explore AWS Cost and Usage Report
3. Combine AWS Cost and Usage Report with Office Dog Leasing business data
4. Explore Elastic Load Balancing Access Logs
5. Calculate a KPI with sustainability proxy metrics
6. Optimize the example application
7. Monitor the development of the KPI

At the end of the you will have...

... helped Office Dog Leasing to find out about their data movement.

... made their application more resource efficient.

... quantified the improvements.

... made the dogs happy!



Access your AWS account – Part 2

- Go to: catalog.workshops.aws/join
- Access code:
18e3-048211-ea



Sign in
Choose a preferred sign-in method

Email one-time password (OTP)

Enter your personal or corporate email to receive a one-time password

Login with Amazon

Login with your Amazon.com retail account

Amazon employee

Login with your Amazon Corporate account. Only for Amazon Employees.

A screenshot of the AWS Sign In page. The 'Email one-time password (OTP)' button is highlighted with a red border. Below it, there are three other sign-in options: 'Login with Amazon', 'Amazon employee', and 'Login with your Amazon Corporate account. Only for Amazon Employees.'.



Please complete the
workshop survey

<https://www.aws-experience.com/emea/dach-cee/event-survey/78a2e304653f-5628-bc34-a644-e8dc70d7>





EMEA HEALTHCARE & LIFE SCIENCES WORKSHOPS

<https://aws-experience.com/>

- June 27th: AWS Cloud Fundamentals
- June 28th: Genomic Data Analysis with Amazon Omics
- July 4th: Machine Learning
- July 5th: AWS for Pharma Manufacturing
- July 6th: Security, Encryption & Data Protection Immersion Day
- July 11th: Sustainability
- July 13th: High-performance computing
- July 18th: Compliance in the Cloud