
AWS
re:Invent
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SUS210

Modeling climate change impacts and risks at scale

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Agenda

Introduction to ESG

Introduction to climate risk

Climate risk data processing on AWS

How AXA Climate built a solution

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Introduction to ESG

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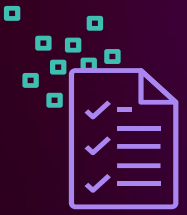
Sustainability is a top priority for financial services institutions



Net-zero commitments



Environmental, social, and governance (ESG) regulations



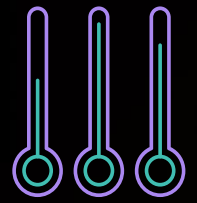
Commercial opportunities

1 https://www.gfanzero.com/press/amount-of-finance-committed-to-achieving-1-5c-now-at-scale-needed-to-deliver-the-transition/
2 https://www.fsb.org/2021/10/2021-status-report-task-force-on-climate-related-financial-disclosures/
3 Morningstar Global_ESG_Q4_2021_Flow_Report

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ESG encompasses a multitude of nonfinancial factors

Environmental



Conservation and protection of the natural environment

Social



Relationships with employees, suppliers, clients, and communities

Governance



Standards for company leadership, risk controls, and shareholder rights

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ESG themes for Amazon and AWS

Environmental



Reducing carbon footprint



Sourcing eco-friendly materials and the circular economy



Optimizing packaging

Social



Working with socially responsible vendors



Inclusion, diversity, and equity

Human Rights



Governance



Stakeholder engagement



Business ethics



Consumer data privacy and security

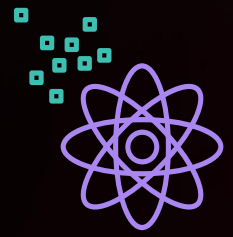
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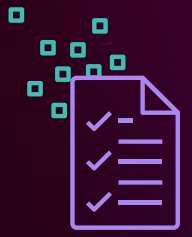
ESG data presents challenges for financial services firms



Huge volumes of data



No single standard for reporting ESG data



Infrequent ESG reporting

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AWS caters to financial institution’s ESG data needs

Data sourcing and management



Source and purchase data



Clean, process, and integrate the data

Data analytics and machine learning



Build your own ESG scoring models



Apply analytics and machine learning

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Introduction to climate risk

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Background to climate change

It is widely recognized, that continued emission of greenhouse gases will cause further warming of the Earth and that warming above 2° Celsius (2° C), relative to the pre-industrial period, **could lead to catastrophic economic and social consequences**[1]

In December 2015, nearly 200 governments agreed to strengthen the global response to the threat of climate change, referred to as the **Paris Agreement**[2]

1 Intergovernmental Panel on Climate Change, Fifth Assessment Report, Cambridge University Press, 2014.
2 United Nations Framework Convention on Climate Change, ”The Paris Agreement,” December 2015.

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Further and faster, together

September 19, 2019

Amazon and Global Optimism announced the Climate Pledge, a commitment to meet the goals of the Paris Agreement 10 years early – and achieve net-zero carbon by 2040. Amazon is a cofounder and first signatory of the Climate Pledge.







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What is climate risk?

The Task Force on Climate-Related Financial Disclosures (TCFD) divided climate-related risks into two major categories[1] –

1. **Transition risks –** Related to the transition to a lower-carbon economy
2. **Physical risks –** Physical impacts of climate change

1 Recommendations of the Task Force on Climate-related Financial Disclosures, TCFD, June 2017

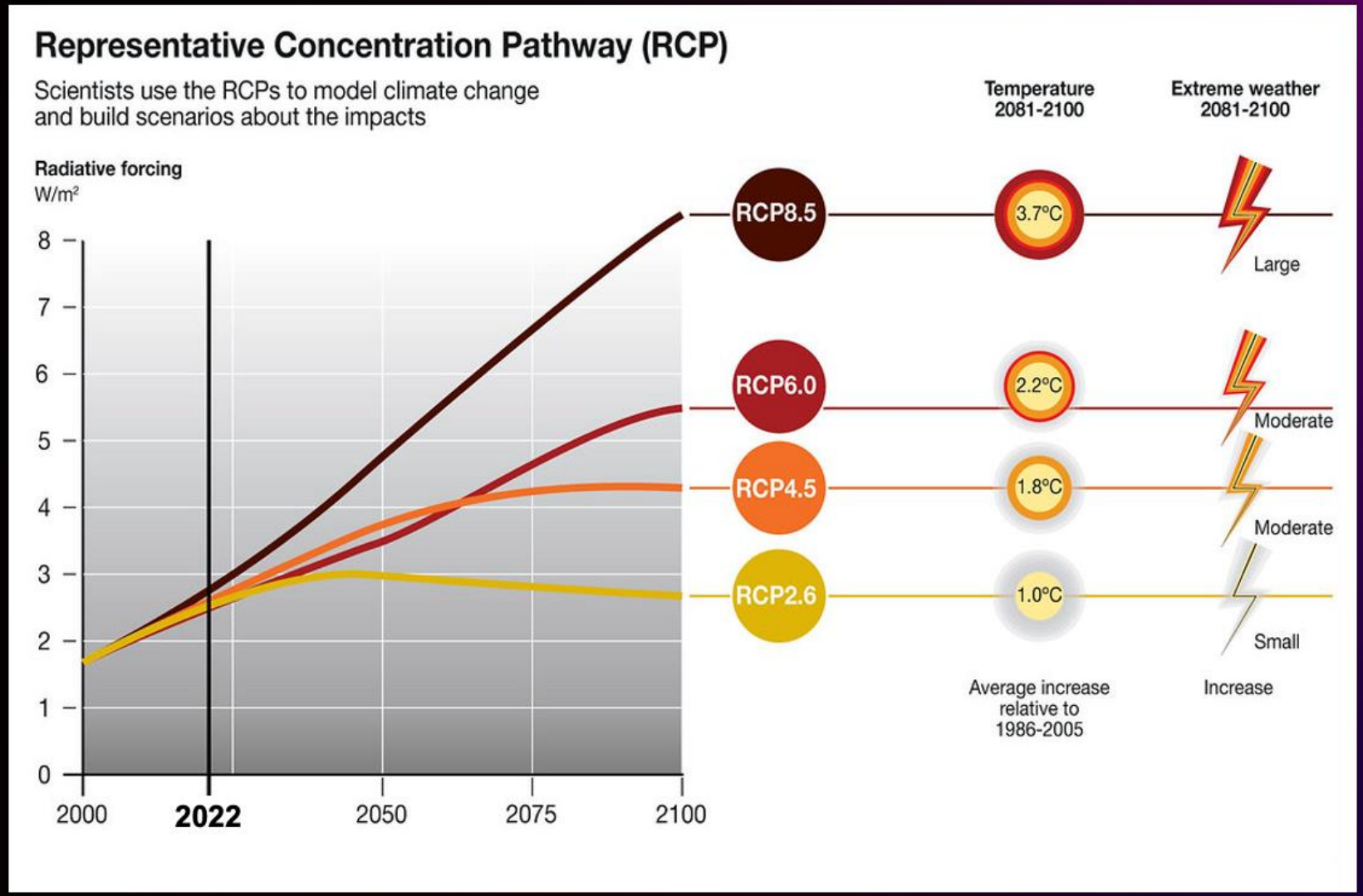
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How to figure out what will happen?

Representative Concentration Pathway(s) (RCPs) are trajectories of greenhouse gas concentrations used for climate modelling

Radiative forcing is the change in the balance between radiation coming into the atmosphere and radiation going out, measured in Watts/m^2



Representative Concentration Pathway (RCP), GRID-Arendal/Studio Atlantis https://www.grida.no/resources/15562, 2022

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Data processing on AWS to help understand climate risk

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AWS provides the technology to overcome ESG data challenges

Data sourcing and management



Source and purchase data



Clean, process, and integrate the data

Data analytics and machine learning



Build your own ESG scoring models



Apply analytics and machine learning



AWS Data Exchange



Amazon Sustainability Data Initiative



Amazon S3



AWS Lake Formation



AWS Glue



Amazon Redshift



Amazon Athena



Amazon FinSpace



Amazon SageMaker



Amazon Textract

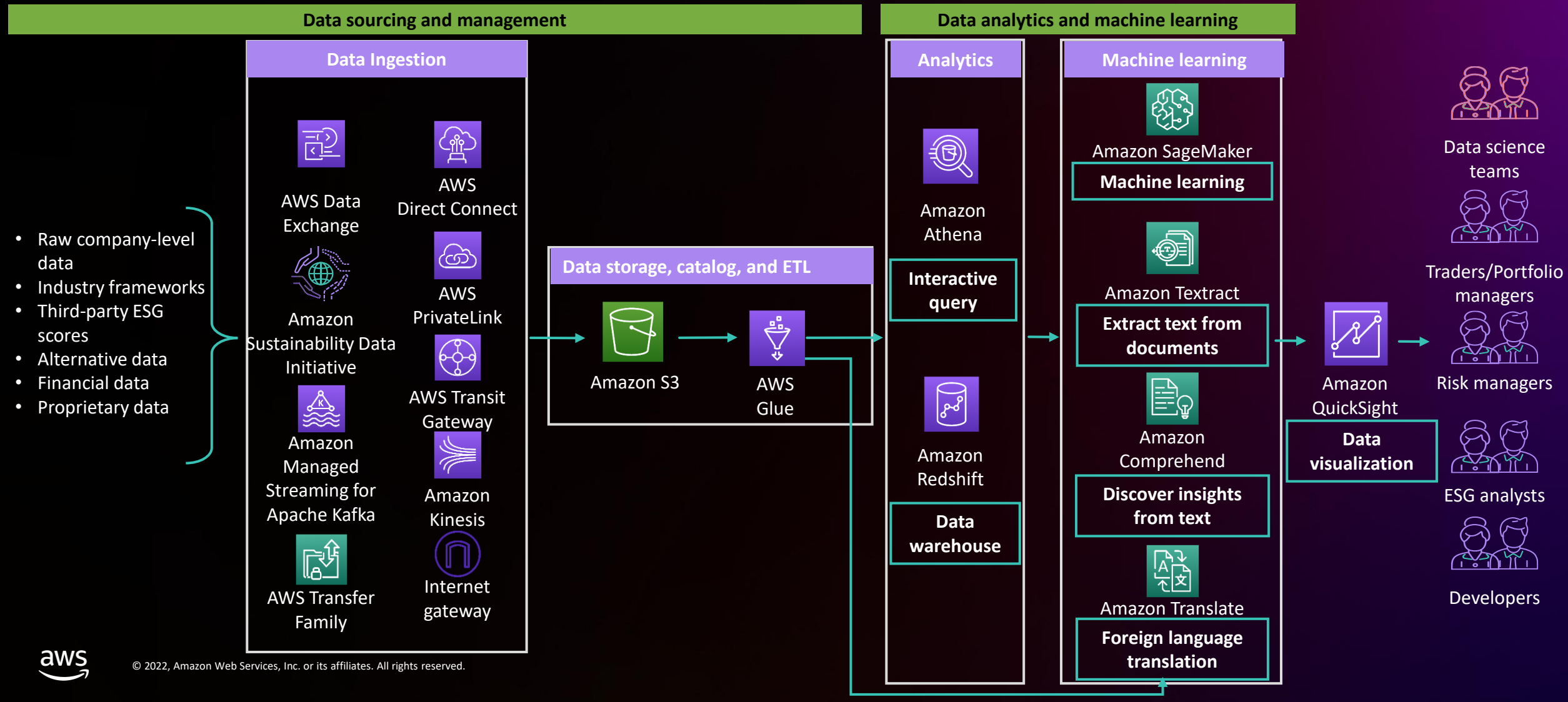


Amazon Comprehend

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Reference architecture

SOURCE, PROCESS, INTEGRATE, AND ANALYZE ESG DATA IN MINUTES



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Solve ESG data sourcing challenges with AWS

Company-level ESG and financial data



AWS Data Exchange

Scientific, government and geospatial data



Amazon Sustainability Data Initiative (ASDI)

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How AXA Climate built a solution

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Introduction of AXA Climate

AXA Group

- $100B revenues, ~100M customers
- 150k employees, 50+ countries
- In top 5 insurance companies
- A leading worldwide insurer for businesses

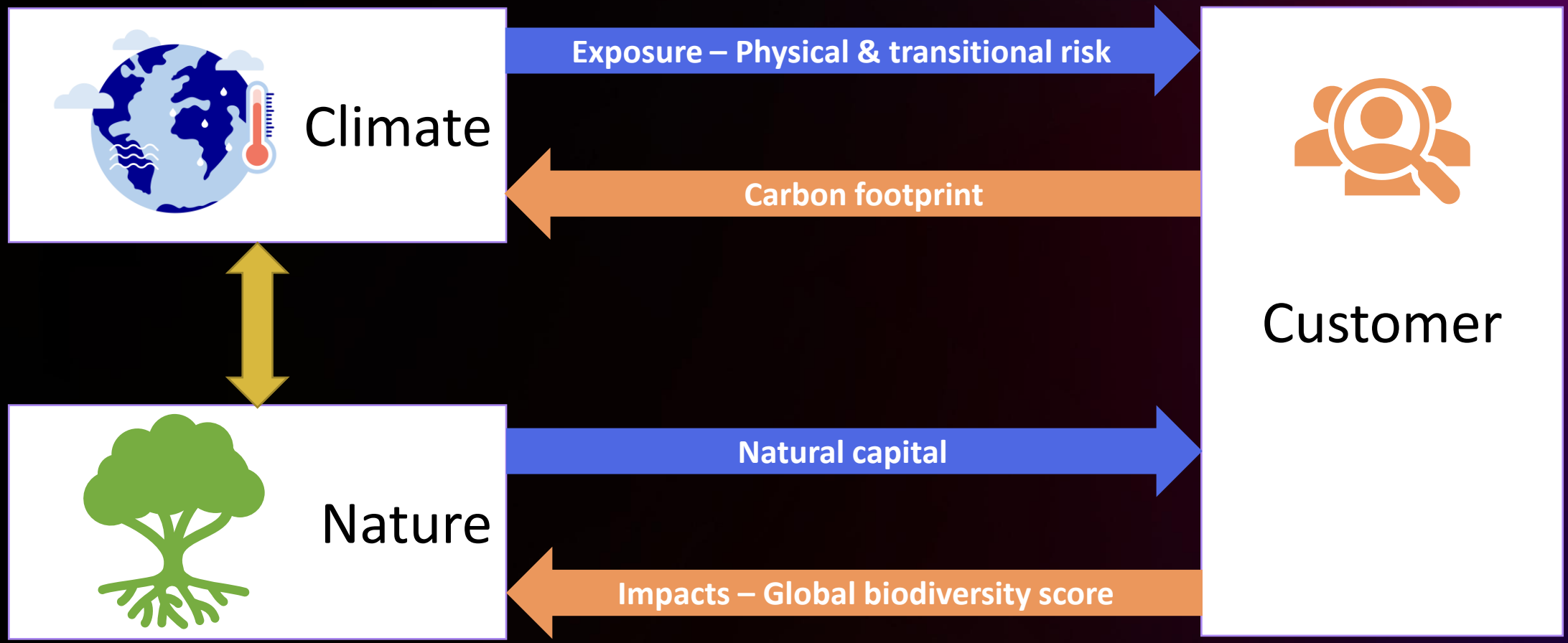
AXA Climate Entity of AXA Group, founded in 2019

- $18M turnover, 300 customers
- 150 employees, 40 countries
- A world leader in parametric insurance business
- 4M people have access to climate school trainings

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Our business goals

Evaluate the impacts of climate change for our customers / Impact of organizations over climate and nature



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Challenges

Business requirements – I want to model any indicator, quickly, with reusability, cheaply, and for the entire world

Start small – And scale up to model the entire world

Multiple businesses – Reusability of indicators

Be secure and reliable – AXA is regulated

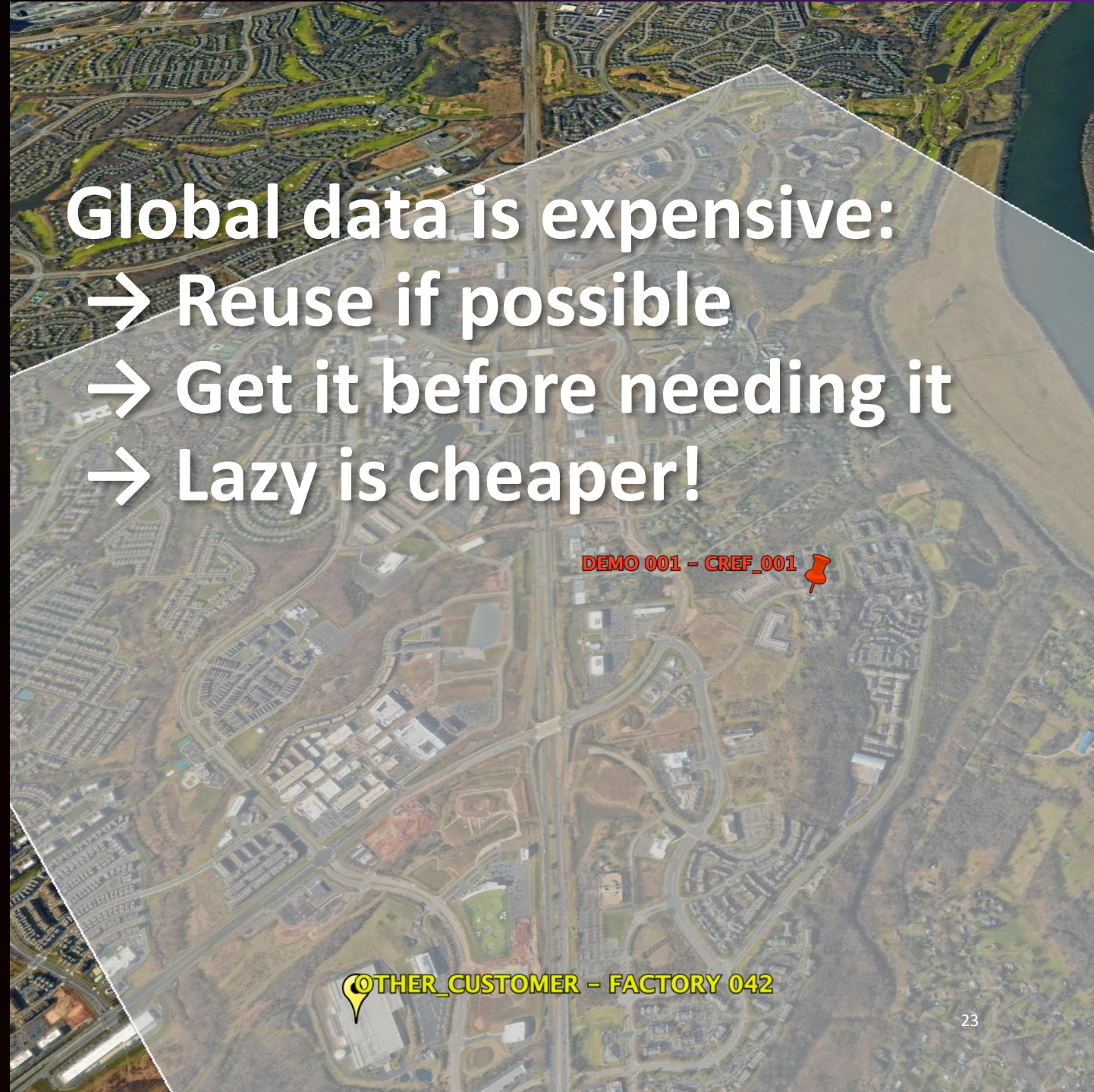
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Example input data

2 customers

2 assets

1 satellite picture for both assets



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Think big, start small

Lazy is king

No Customer in Las Vegas → No map

Allows to scale with customers

Lazy is hard

Large data amount to fetch – Long delays

Code must wait and becomes complex

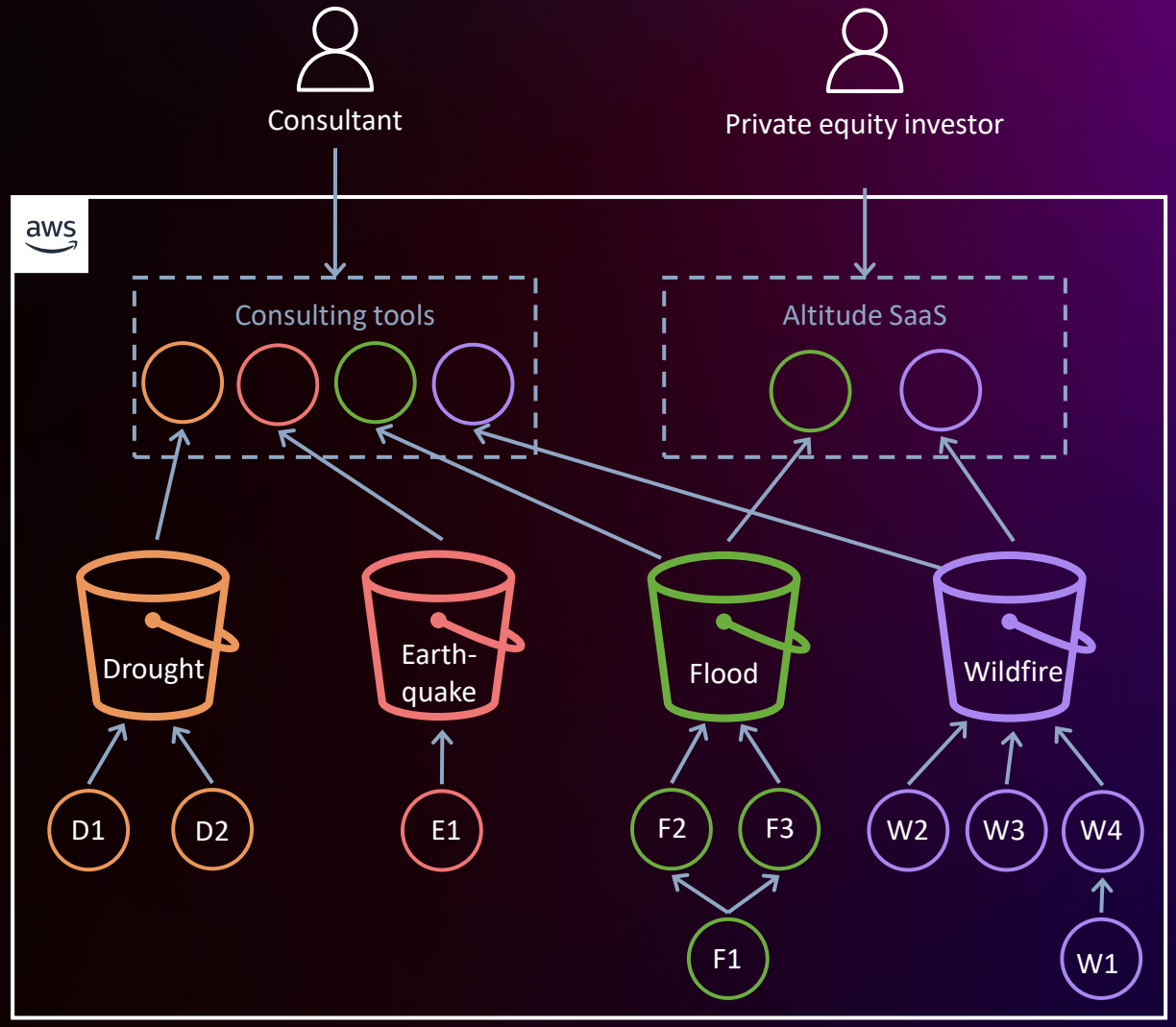
Graph could be a solution!

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Multiple businesses - Reusability of indicators

Business ask for indicators

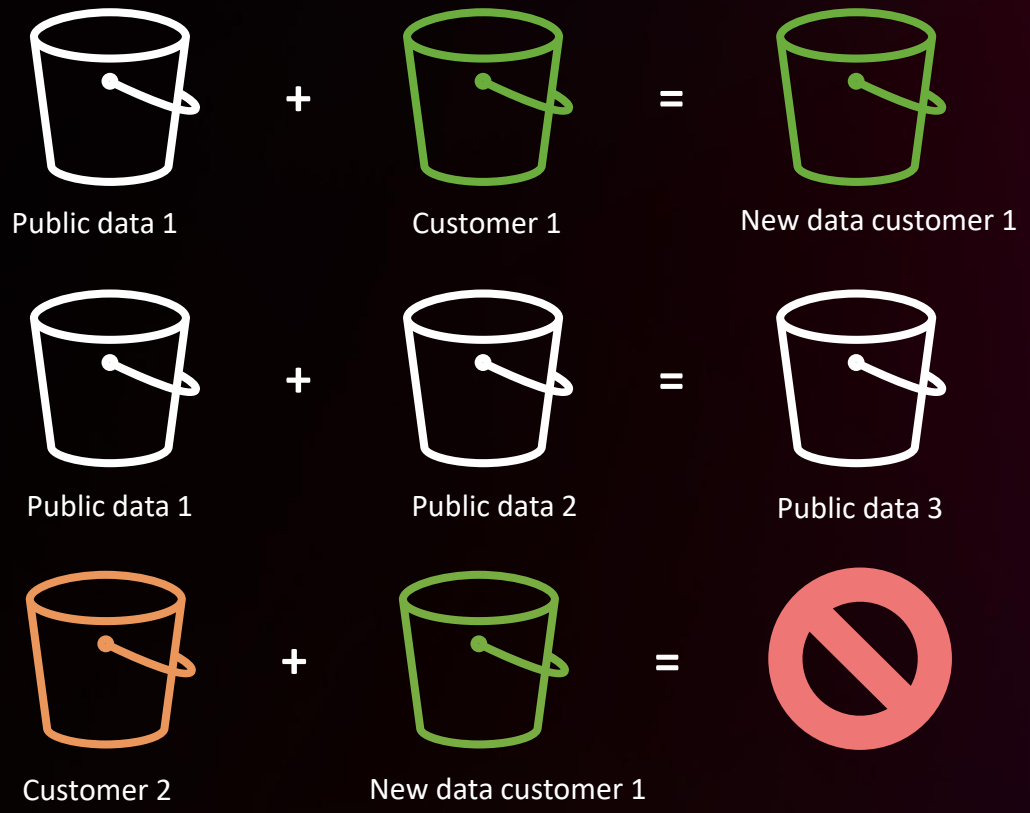
Graph could be a solution!



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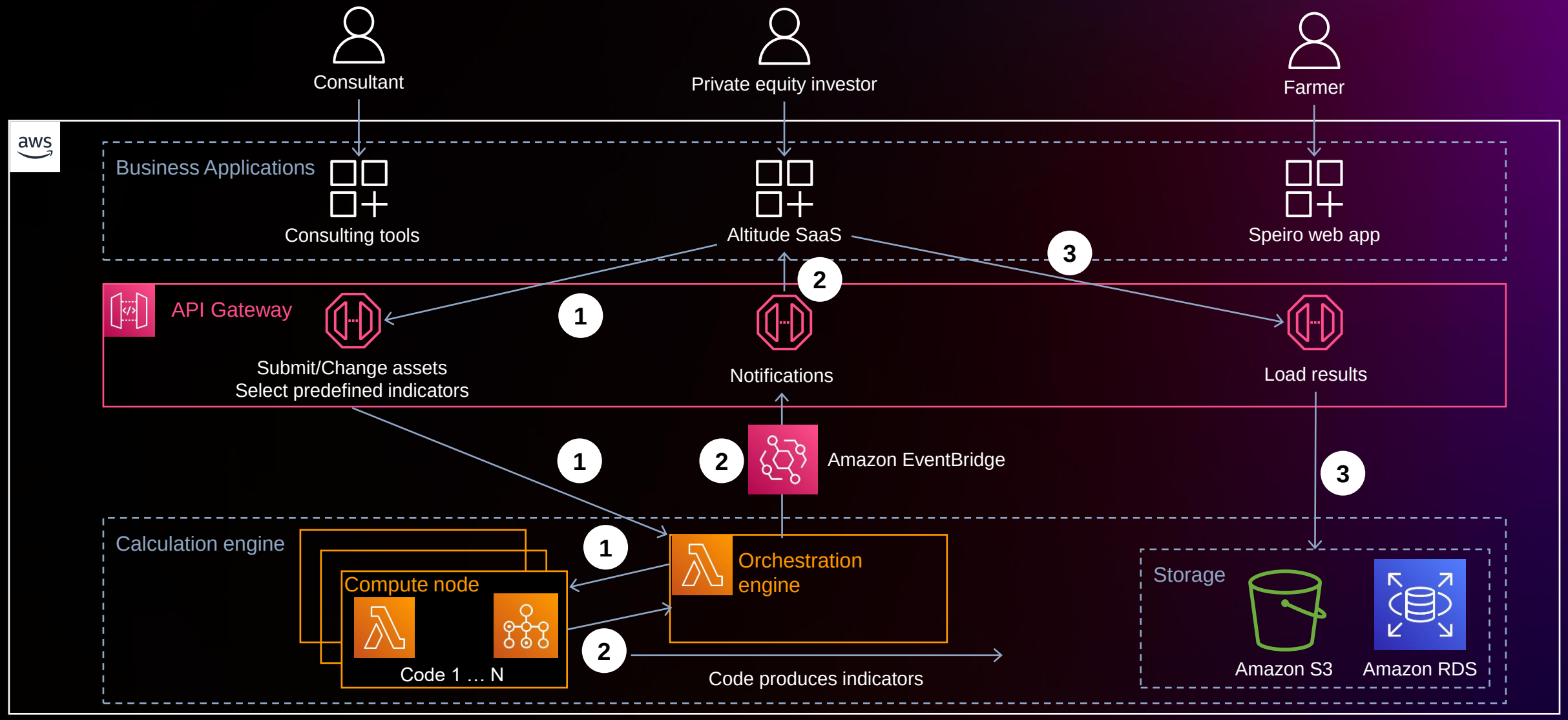
Must be secure and reliable – AXA is regulated

Colorized data lake to ensure data separation



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High-level view of what we do at AXA Climate



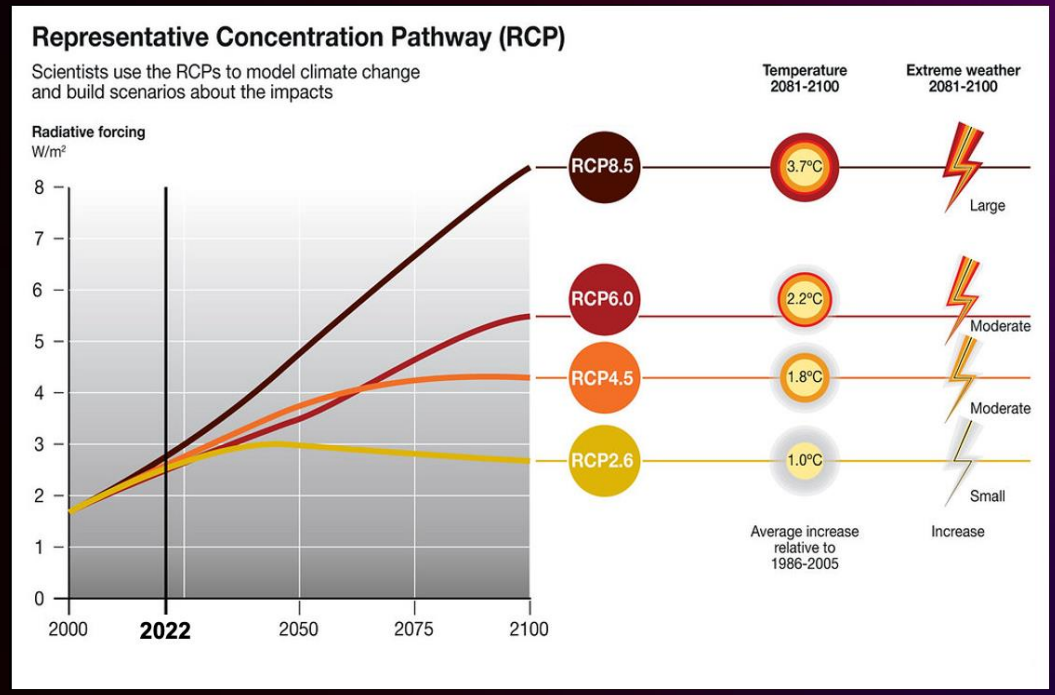
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Handling risk calculations

Many computations

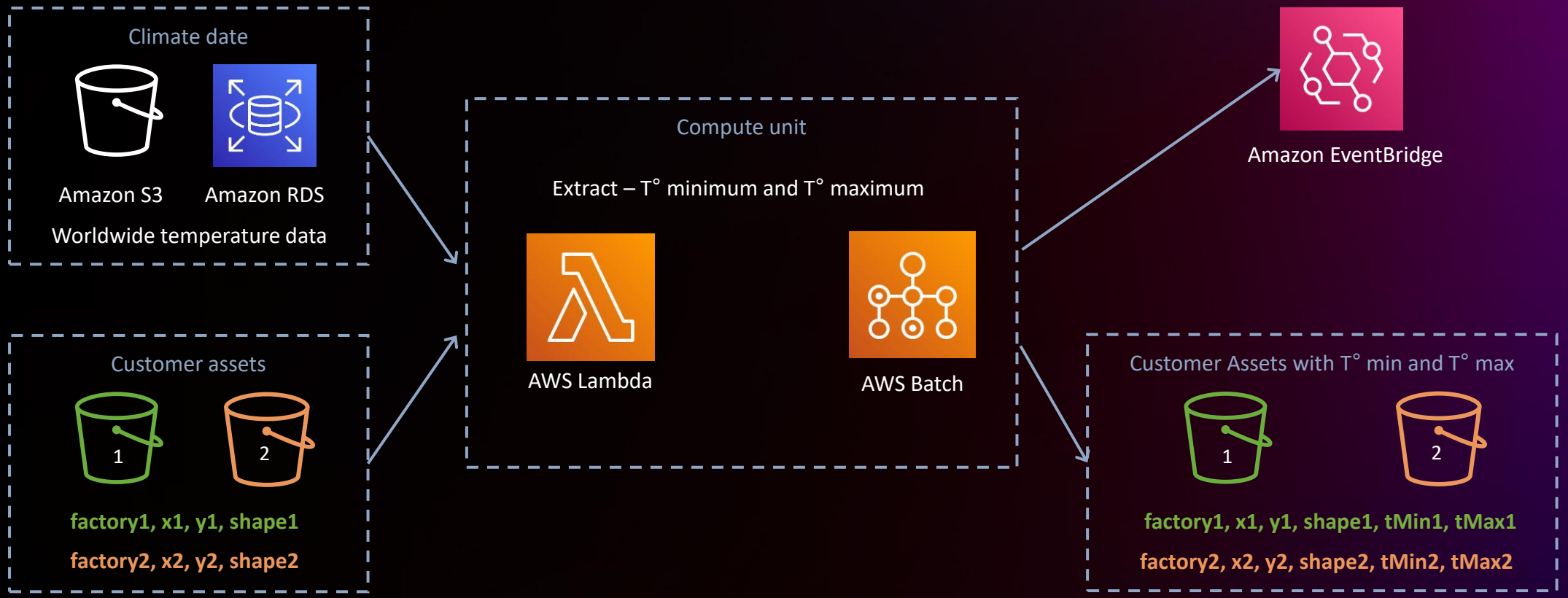
1. Fetch historical data for assets
2. Simulate with many scenarios
3. Compute risks with each of them
4. Compute aggregated risk for client

Many scenarios



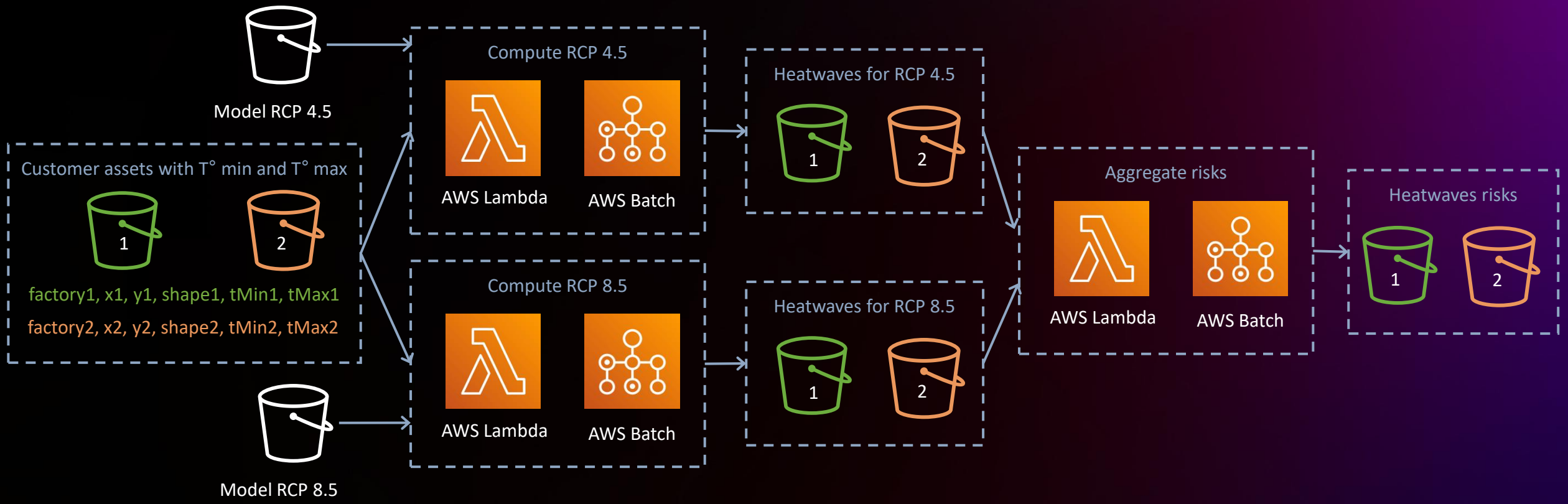
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Computing climate risk



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Computing climate risk



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How we use a graph for risk calculation

Global graphs are static, changed when a new release is published

- A business app chooses outputs to read from, all computations are inferred

- The graph generates roles to set IAM Roles
  - Code can’t create files
  - All files are known
  - Can find ”outdated files”

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Why use a graph for risk calculation?

Each file has full data lineage with file structure and metadata



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The engine to orchestrate risk calculation

The engine is the only component that knows the graph

- Aware of **colorized data**
- Catches notifications from Amazon EventBridge
- Chooses to run on AWS Lambda/AWS Batch
- Automatic parallelization of computations

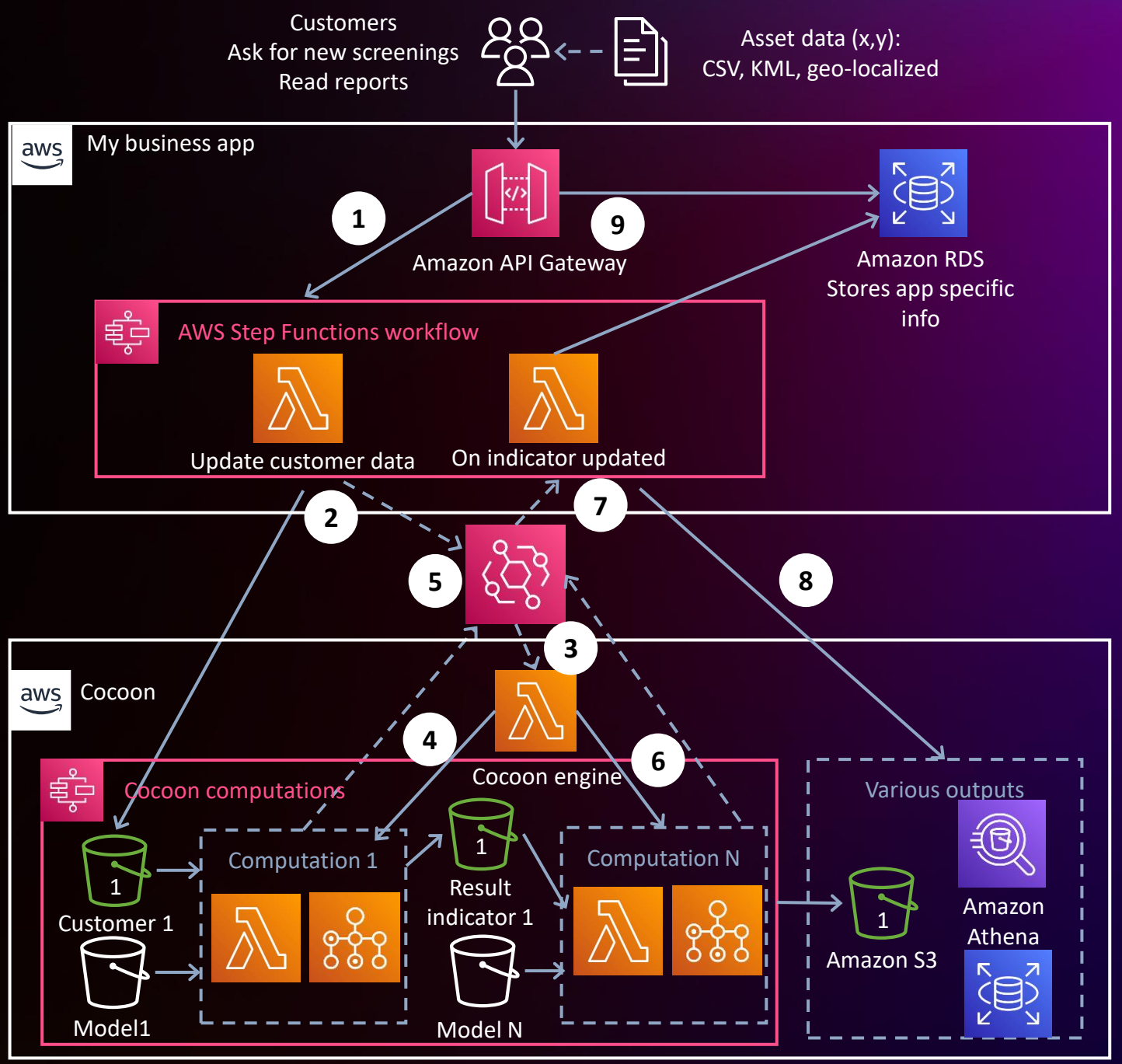
The engine can auto-fix itself

- It can fix missing or outdated results – No-Ops model
- Design for failure – Live reports of broken code and indicators

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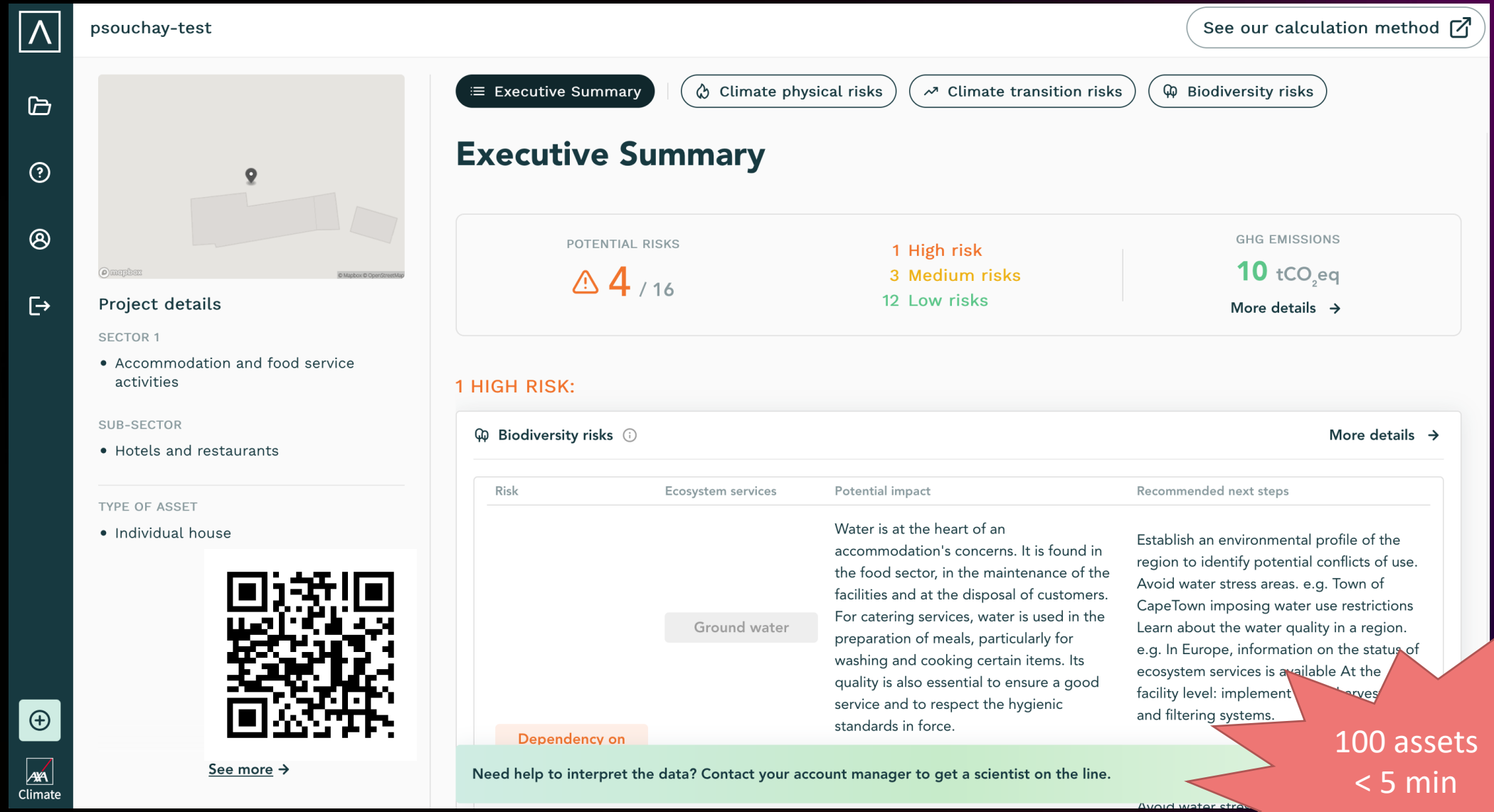
Detailed architecture

1. Customer uploads data via API
2. AWS Step Functions send data & notify
3. Risk calculation engine is notified
4. Engine starts computations
5. Engine notifies app when finished
6. Engine can calculate more indicators
7. App is notified to download all results
8. App downloads results
9. App presents summary to user



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Business apps – Altitude



100 assets
< 5 min

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Business apps – Consulting



100 assets
< 15 min

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AXA Climate's outcomes

KPIs

- From specification to production ~15 days
- 300+ customers, 800 computations on 3000+ indicators built in 1year/4 people

Security driven by functional computations

- 8,500 IAM rules and Amazon S3 prefixes automatically created by the graph

Several businesses are using our solution

- 3 production apps
- 1 retired app (did not find business)
- New app from scratch: ~3 weeks

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Summary

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Takeaways on climate risk modelling

1. **Climate risk** can be defined by transition – and physical risks
2. **ESG** data presents challenges for financial services firms
3. **AWS** provides the technology to overcome ESG data challenges
4. **AXA Climate** provides a solution to evaluate the impacts of climate change for their customers as well as the impact of organizations over climate and nature

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Thank you!

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