

# AWS State, Local, and Education Learning Days

Phoenix



# AI/ML For Data and Analytics

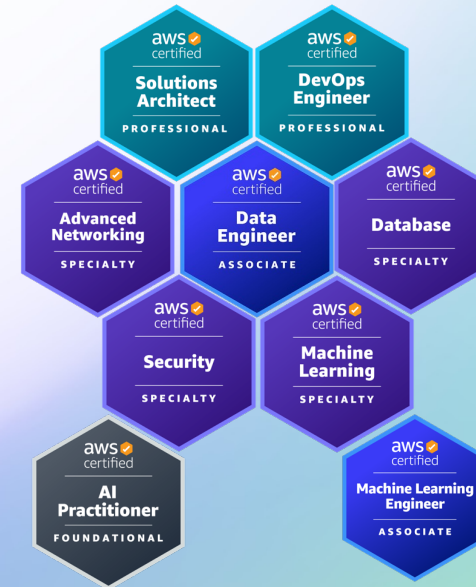
## Archit Malpure

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## Aditya Challa (Adi)

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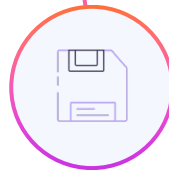
# Challenges we're hearing



**Demand is rising**, while resources and capacity to deliver them aren't keeping pace



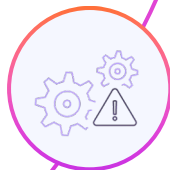
**Expectations are rising**, with constituents demanding the same digital experiences they get from the private sector



**Infrastructure is aging**, creating friction across the data lifecycle (capture, storage, management, leveraging)

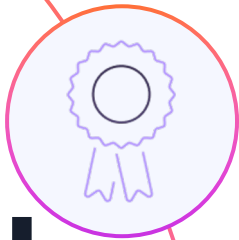


**Requirements are becoming more complex**, creating barriers to change and blocking adoption of "built for change" solutions



**Change is slowing**, with risk-averse cultures introducing inertia and thwarting innovation

# What internal and external customers are asking for



**Better experiences** that minimize time to access, provide self-service capabilities, and deliver in joined-up ways

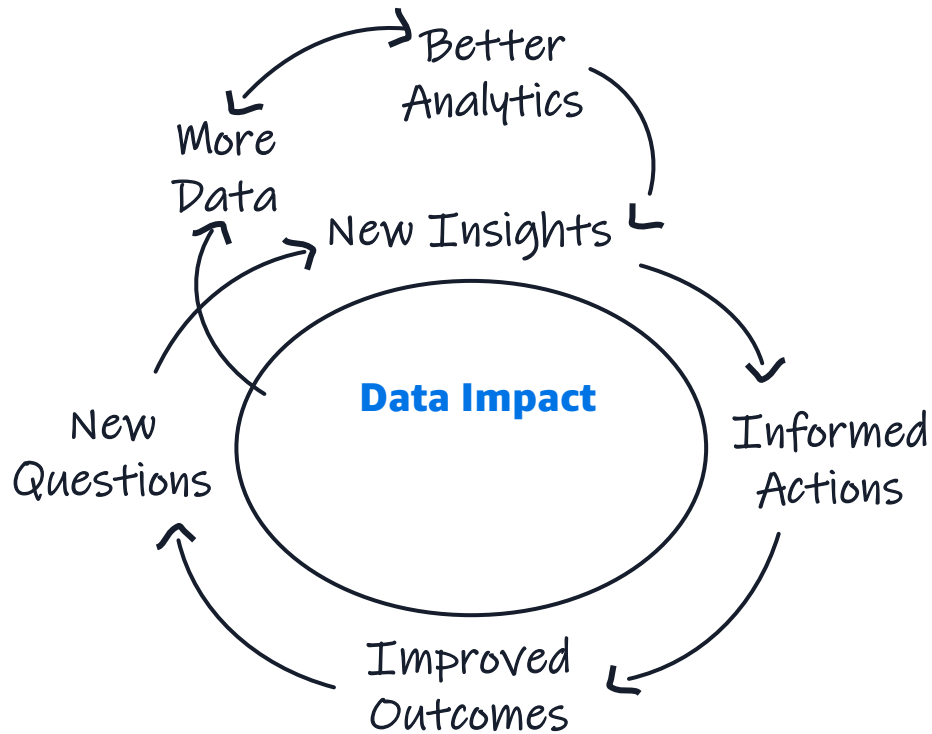


**More productive staff** who have answers at their fingertips and aren't stuck doing manual work



**Empowered teams** that focus on outcomes, use make data-informed decisions, and meet legal and policy requirements

# The Data Driven Organization



“An organization that harnesses data as an **asset** drive **sustained innovation** and create **actionable insights** to **improve policy making decisions** that reflect outcomes constituents care about, that builds greater **trust**.”

## Key Characteristics



Set 'Think Big' goals



Focus on delivering policy priorities with quality



Shared leadership conviction and Business-IT alignment on data ownership



Strong collaboration and agility concerning data products across data producers and consumers

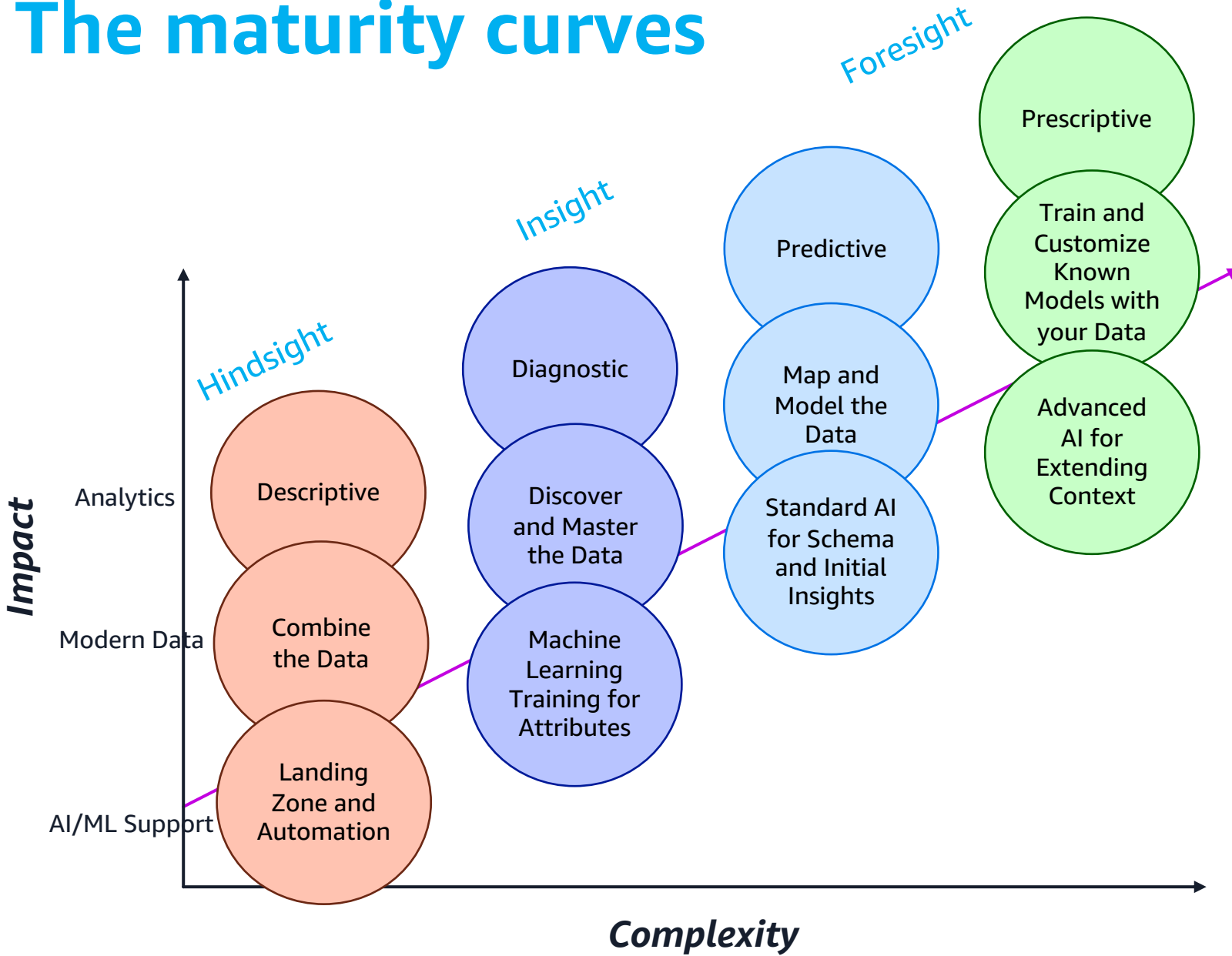


Upskilled and empowered producers and consumers who self-serve



Privacy, security, compliance and federated governance without impeding innovation

# The maturity curves



DESCRIPTIVE

**What happened?**

DIAGNOSTIC

**Why did it happen?**

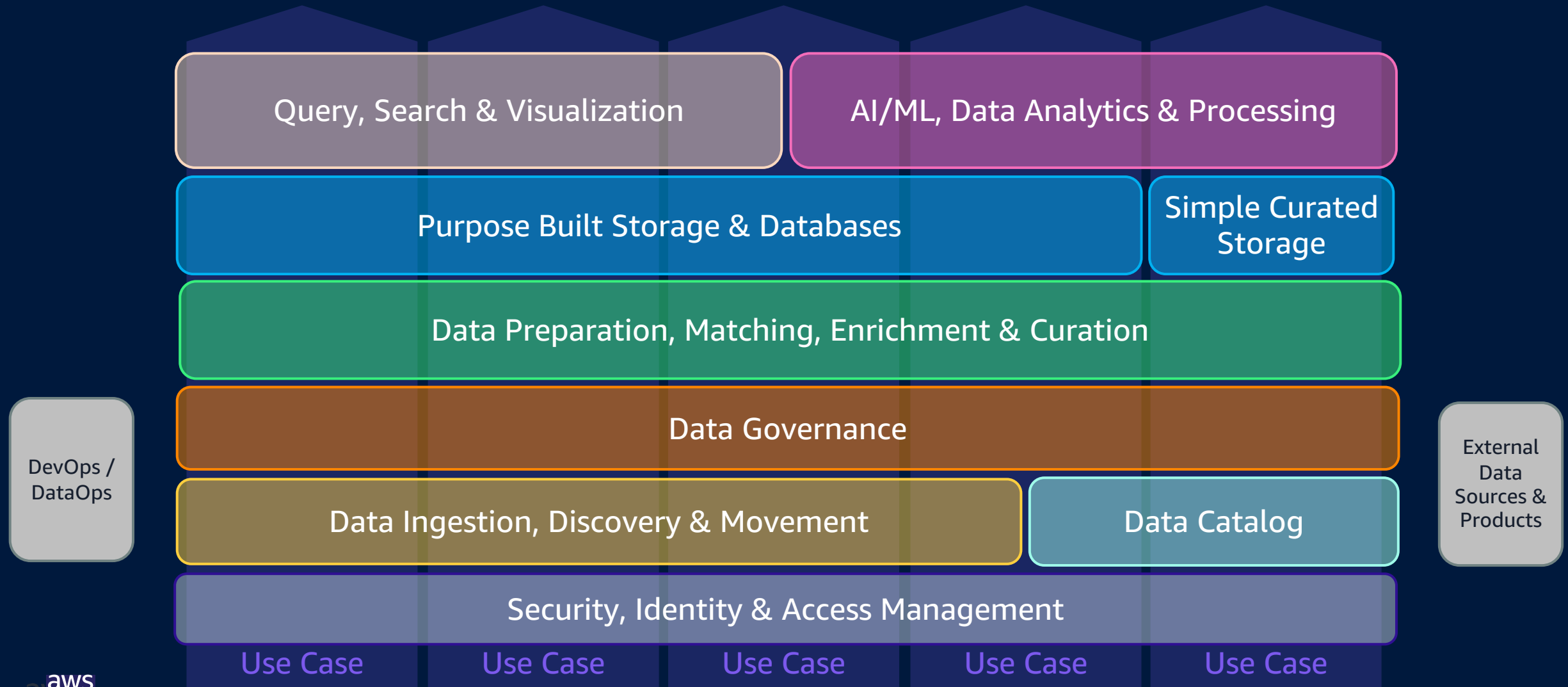
PREDICTIVE

**What will happen?**

PRESCRIPTIVE

**How do we make it happen?**

# A Modern, Foundational Data Architecture



# Build a Modern, Foundational Data Architecture

Built in AI/ML Capabilities

AI/ML enabled/integrating services

## Query, Search & Visualization

**Athena**  
Interactive analytics

**QuickSight**  
Visualizations

**OpenSearch**  
Operational Analytics

**Redshift**  
Data warehousing

## AI/ML, Data Matching & Processing

**SageMaker**  
ML

**Comprehend**  
NLP

**Transcribe**  
Speech-to-text

**Textract**  
Extract text

**Health Lake**  
Health Data Lake

**Comprehend Medical**  
NLP

**Translate**  
Translation

Specialized Partner Solutions

+ more

## Data Preparation, Enrichment & Analysis

**Glue**  
Serverless Data Integration

**EMR**  
Hadoop + Spark

**Glue DataBrew**  
Data Preparation & Transformation

**Forecast**  
Forecasts

**Kinesis Data Analytics**  
Real time

## Data Ingestion, Integration & Movement

**Glue**  
Serverless Data Integration

**Kinesis Data Streams**  
Data Streaming

**Data Exchange**  
Data exchange

**Clean Rooms**

**API Gateway**  
API Management

**Kinesis Data Firehose**  
Streaming ETL

**Data Migration Service**

**AppFlow**

**Data Pipeline**

**DataSync**

## Data Storage & Databases

**S3/Glacier**

**RDS**  
MySQL, PostgreSQL, MariaDB, Oracle, SQL Server,

**Keyspaces (For Apache Cassandra)**  
Wide column

**Neptune**  
Graph

**Aurora**  
MySQL, PostgreSQL

**Redshift**  
Data warehousing

**DocumentDB**  
Document

**Timestream**  
Time Series

## Data Catalog

**Glue**  
Data Catalog

## Data Governance

**Lake Formation**  
Data Lakes

**DataZone**  
Governed Analytics

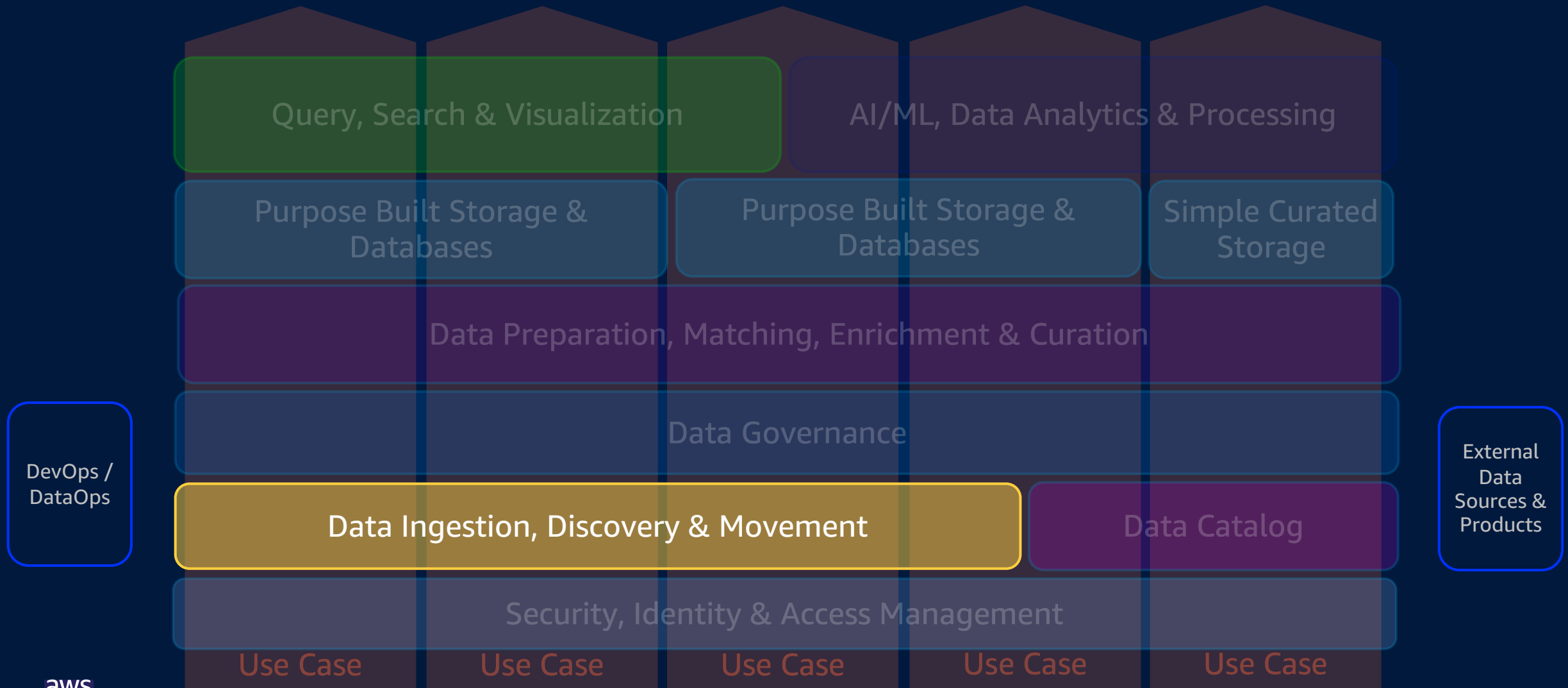


# Machine learning

- Data Discovery
- Data Attribution
- Metadata Tags
- Schema Definitions
- Data Catalogues
- Data Protection



# A Modern, Foundational Data Architecture





# Content analysis and object detection

Extract insights and identify objects of interest from large volumes of images and videos with Amazon Rekognition

- Detect personal protective equipment (PPE) to improve worker safety
- Analyze vehicle traffic and pedestrian and bicycle safety
- Detect objects of interest in video and reduce human effort required to review footage



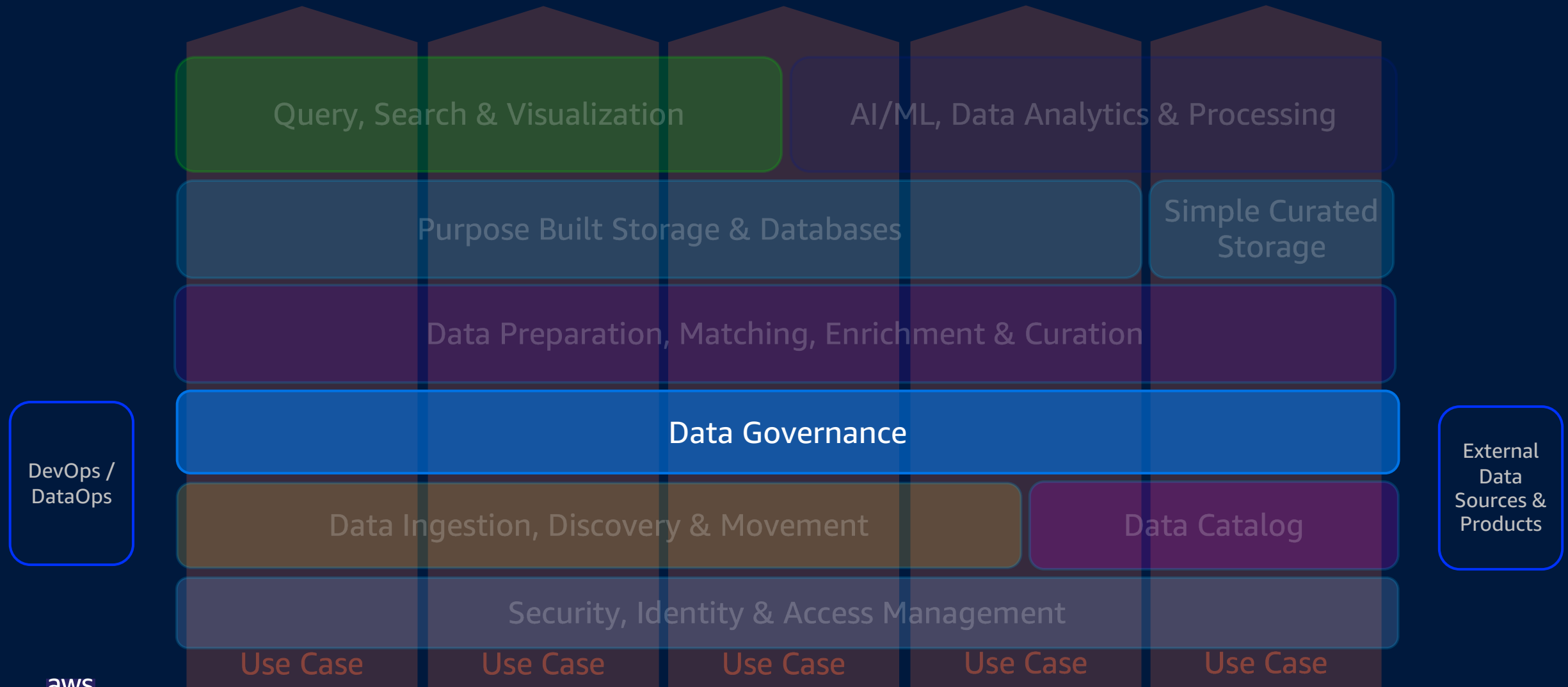
# Text to Speech Transcription, Classification & Analytics

AN EXAMPLE FROM AWS POST CALL ANALYTICS AND CALL SUMMARIZATION

The screenshot displays the AWS Post Call Analytics and Call Summarization interface. It is divided into several sections:

- GenAI Transcript Summary:** Provides a summary of the call, AI Customer Sentiment (Positive), AI Agent Sentiment (Neutral), and a suggestion for improvement: "How could the overall experience be improved? The agent could have not assumed the customer's pronouns, and also asked for their address."
- Transcript:** Shows the call transcript with speaker labels (Agent and Customer) and timestamps. The customer's statement "Hi, [Issue]: I'm calling about my rewards card." is highlighted.
- Call Analytics Summary:** Displays the issue ("I'm calling about my rewards card."), action items ("No action items detected."), and outcomes ("your card balance is \$75.34.").
- Call Details:** A detailed view of the call with the following information:
  - Call Metadata:** Timestamp (2023-02-22 12:23:49), Guid (102), Agent (AndrewK), Call Duration (03:02), Entity Recognizer Name (sample-entities.csv), Language Model (en-US), Agent Sentiment (Trend: ↗), and Customer Sentiment (Trend: ↗).
  - Transcribe Details:** Type (Transcribe Call Analytics), Job Id (Card2\_GUID\_102\_AGENT\_AndrewK\_DT\_2023-02-22T12-23-49.wav), File Format (wav), Sample Rate (8000), PII Redaction (Enabled), Custom Vocabulary (-), Vocabulary Filter (-), and Average Word Confidence (97.9%).
  - Sentiment:** A line chart showing sentiment scores for Customer and Agent across four quarters (Q1, Q2, Q3, Q4). The Customer score starts at 0 and rises to approximately 4, while the Agent score starts at approximately 3 and drops to 0 before rising to approximately 4.
  - Speaker Time:** A stacked bar chart showing the percentage of time spent by the Agent (yellow, ~60%), Customer (purple, ~40%), and Silence (cyan, 0%) during the call.

# A Modern, Foundational Data Architecture



# Data governance

## Data Protection

ML-powered sensitive data identification and redaction

[Amazon Macie](#) is a data security service that uses machine learning (ML) and pattern matching to discover and help protect your sensitive data.

## Data Quality

Use ML to detect anomalies and hard-to-detect data quality issues

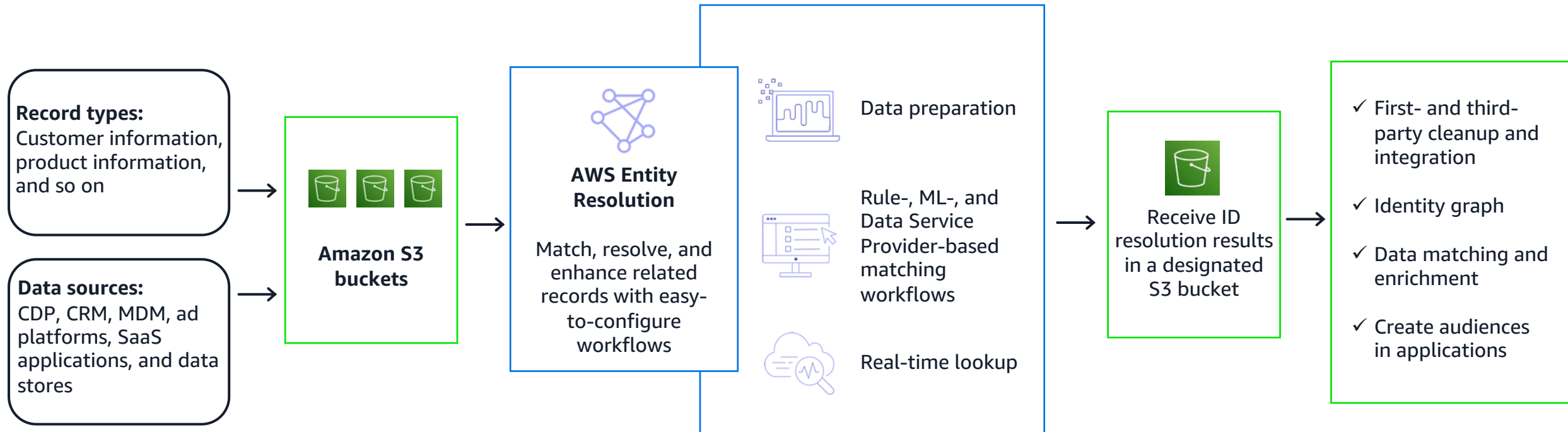
[AWS Glue Data Quality](#) learns patterns on data statistics gathered over time using ML algorithms. It detects anomalies, unusual data patterns and alerts users. It also auto-creates rules to monitor these specific patterns so that you can progressively build data quality rules.

## Entity Resolution & Data Matching

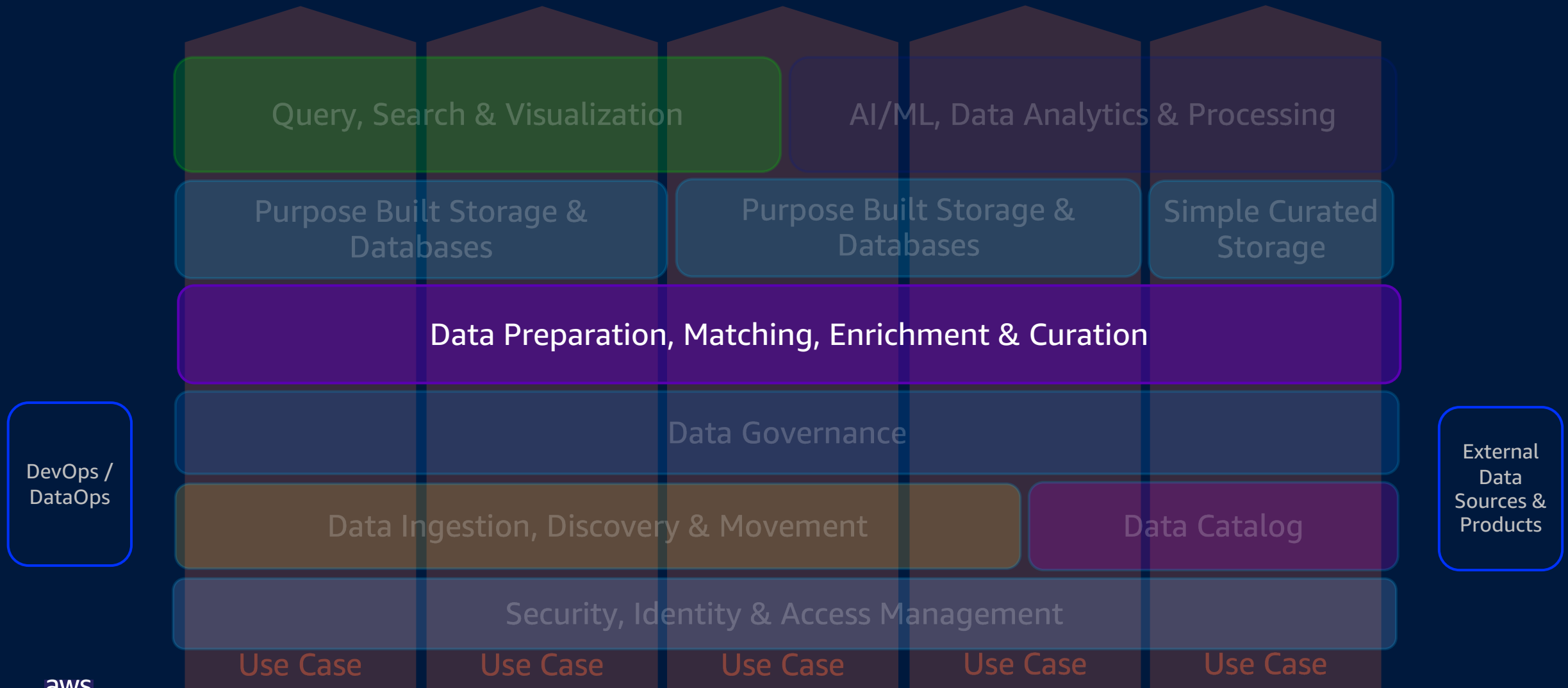
Match, link, and enhance related customer, product, business, or healthcare records stored across multiple applications, channels, and data stores

[AWS Entity Resolution](#) and [AWS LakeFormation FindMatches](#) enable you to identify matching records in your dataset even when the records do not have a common unique identifier and no fields match exactly.

# ML-powered matching and entity resolution



# A Modern, Foundational Data Architecture



# Data Preparation, matching, enrichment and curation

ML-based data transformations

ML-generated data insights & data augmentation

- Trends, anomalies, categorization, classification, labeling, sentiment, summarization, etc.

ML services for can be integrated into data processing jobs

- E.g., translation, inference, labeling, etc.

Generative AI powered data integration coding assistance

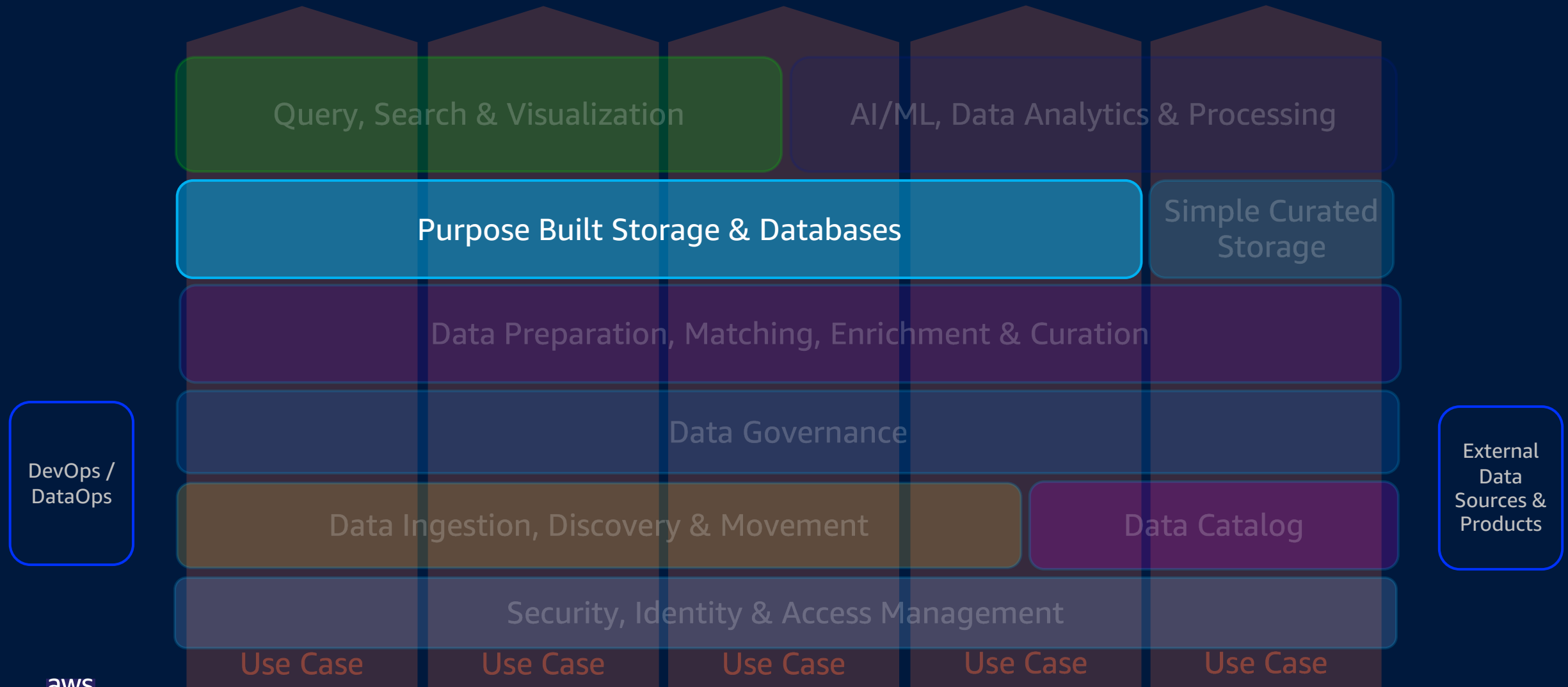
# Generative AI assistance for data integration

The screenshot displays the AWS Glue Studio interface. At the top, the navigation bar includes the AWS logo, 'Services', a search bar, and the user's location 'Tokyo' and username 'Username @ 1234-5678-9012'. The left sidebar contains a navigation menu with categories like 'Getting started', 'ETL jobs', 'Data Catalog', and 'Data Integration and ETL'. The main content area is titled 'AWS Glue Studio' and features a 'Create job' section with three options: 'Visual ETL' (highlighted in orange), 'Notebook', and 'Script editor'. Below this is an 'Example jobs' section with a 'Create example job' button. The 'Your jobs (2)' section shows a search for 'demo' with 2 matches, displaying a table of existing jobs.

<input type="checkbox"/>	Job name	Type	Last modified	AWS Glue version
<input type="checkbox"/>	q-demo-taxi	Glue ETL	4/26/2024, 1:19:07 PM	4.0
<input type="checkbox"/>	q-demo	Glue ETL	4/25/2024, 3:41:38 PM	4.0



# A Modern, Foundational Data Architecture

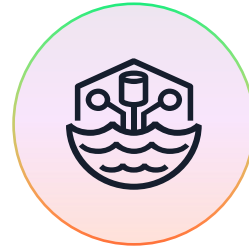


# AWS brings ML closer to data



Databases

+



Data warehouses  
+ data lakes

+



Business  
intelligence tools

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AMAZON  
AURORA ML



AMAZON  
NEPTUNE ML



AMAZON  
REDSHIFT ML



AMAZON  
ATHENA ML



AMAZON  
QUICKSIGHT ML



# ML Purpose-built databases

- Databases with in-built AI/ML support like vector stores (Amazon Aurora PostgreSQL-Compatible & RDS for PostgreSQL, Amazon Neptune ML, Amazon MemoryDB for Redis, Amazon Document DB, and Amazon OpenSearch)
- Integrate ML into queries using run-time inference inside SQL as done in Amazon Redshift ML and Athena ML

# Inference at query time – Link Prediction

## Without inference

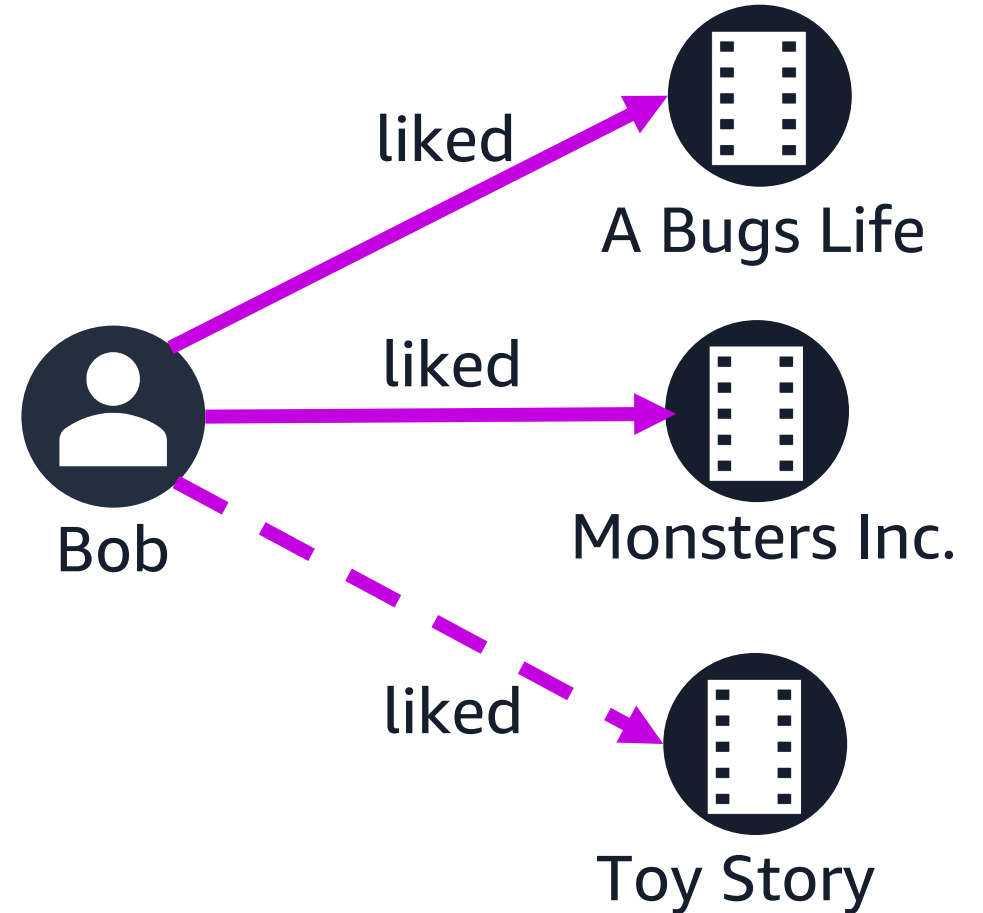
```
g.V().has('name', 'Bob').  
out('liked').  
hasLabel('movie').values('title')
```

- ⇒ A Bugs Life
- ⇒ Monsters Inc.

## With inference

```
g.with("Neptune#ml.endpoint", "ENDPOINT").  
V().has('name', 'Bob').  
out('liked').with("Neptune#ml.prediction").  
hasLabel('movie').values('title')
```

- ⇒ Toy Story



# Train & use models in Amazon Redshift ML

## TRAIN



```
CREATE MODEL customer_churn
FROM (SELECT c.age, c.zip,
c.monthly_spend, c.monthly_cases,
c.active AS label
FROM customer_info_table c)
TARGET label
FUNCTION predict_customer_churn
```



Amazon  
Redshift



Amazon  
SageMaker

## PREDICT



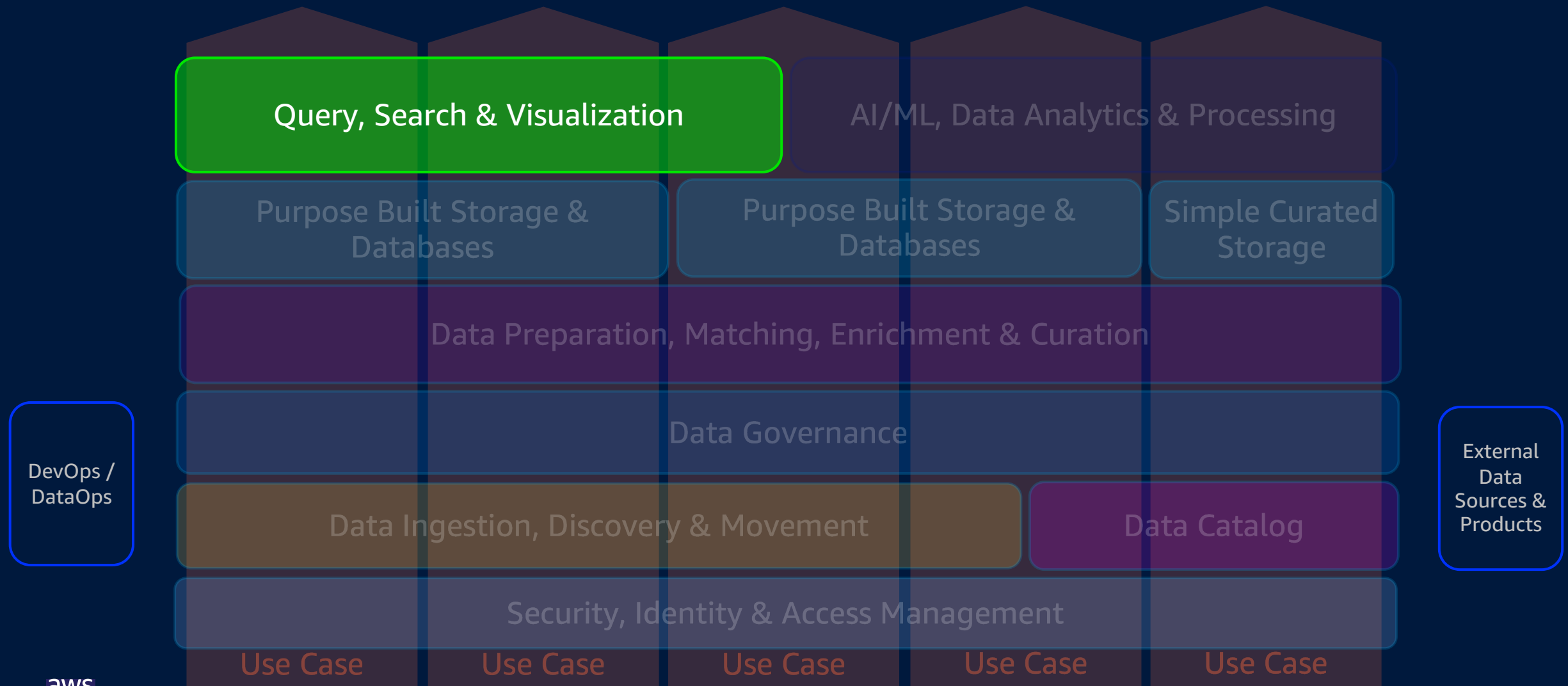
```
SELECT n.id, n.firstName, n.lastName,
predict_customer_churn(n.age, c.zip ...)
AS activity_prediction
FROM new_customers n
WHERE n.marital_status = 'single'
```



Amazon  
Redshift

**Example: Train a model on data from before 2020-01-01, then use the prediction function on the testing set. The following query displays the predictions of whether customers who signed up after 2020-01-01 will go through churn or not.**

# A Modern, Foundational Data Architecture



# AI/ML in Query, Search & Visualization

- Natural Language insights from GenAI database query
  - text-to-sql
  - natural language search
  - Visualization generation
- Content & data summarization & classification
  - AI-assisted data story telling

# AI-powered dashboard authoring experience

A NEW DASHBOARD BUILDING EXPERIENCE POWERED BY GENERATIVE BI

## Build visuals

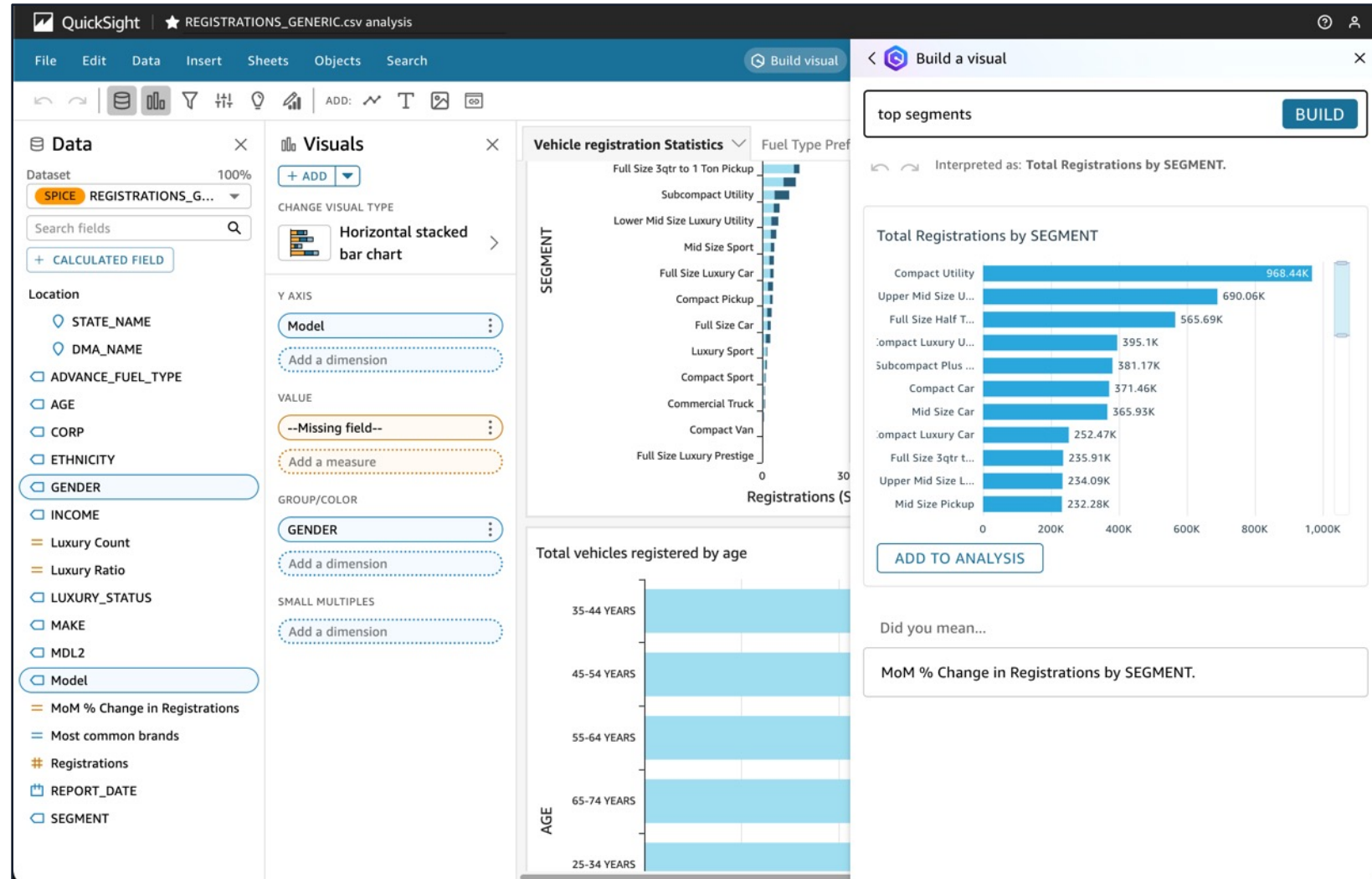
Use natural language to quickly build visuals for dashboards and reports

## Create calculations

Build calculations using natural language without looking up or learning specific syntax

## Refine visuals

Quickly update visuals by describing desired formats using natural language



# AI-assisted storytelling

IMPACTFUL DATA STORYTELLING TO DRIVE ACTIONS

## Interpret data for others

Help others derive meaning from data and reach conclusions to drive decisions

## Generate stories using AI

Produce cohesive, powerful, and insightful narratives by analyzing only a few words of data

## Create refined content

Control AI verbosity, customize narrative text, and apply stunning visual themes to bring content to life

## Share up-to-date governed data

Quickly update and disseminate data at any time

The screenshot displays the Amazon QuickSight interface. The main dashboard is titled "Interests Analysis" and features a radar chart titled "Revenue by primary interest and source". The chart has 14 axes representing different interest categories: Unspecified, Travel, Technology, Sports, Outdoor, Home and, Health, Food and Dining, Finance, Fashion, Entertainment, Education, Wellness, Automotive, and Arts and Culture. The "Unspecified", "Fashion", and "Health" categories show the highest revenue. To the right of the chart, there is a text block that reads: "As shown in the interests analysis graph, fashion, health, and beauty/wellness generated the highest total lead revenues of \$46,113, \$31,041, and \$29,286, respectively. This suggests interests like fashion and wellness have a significant impact on performance and that marketing campaigns should be tailored to target these high-value interest segments." In the foreground, a "Build story" overlay is visible, which is a beta feature. It prompts the user to "Describe your data story in simple language and add the visuals you want to include." Below this prompt, there is a text input field containing the text: "Build a story about marketing campaign performance over time. Describe top campaigns and account managers. How can we improve overall campaign success?". At the bottom of the overlay, there are several visual selection options: "Total impression...", "Monthly impress...", "Most effective i...", and "Comparing reve...". There is also an "ADD VISUALS" button and a "BUILD" button.

# AI answers to questions of data on demand

DEEP INSIGHTS AT YOUR FINGERTIPS

## Executive summaries of dashboards

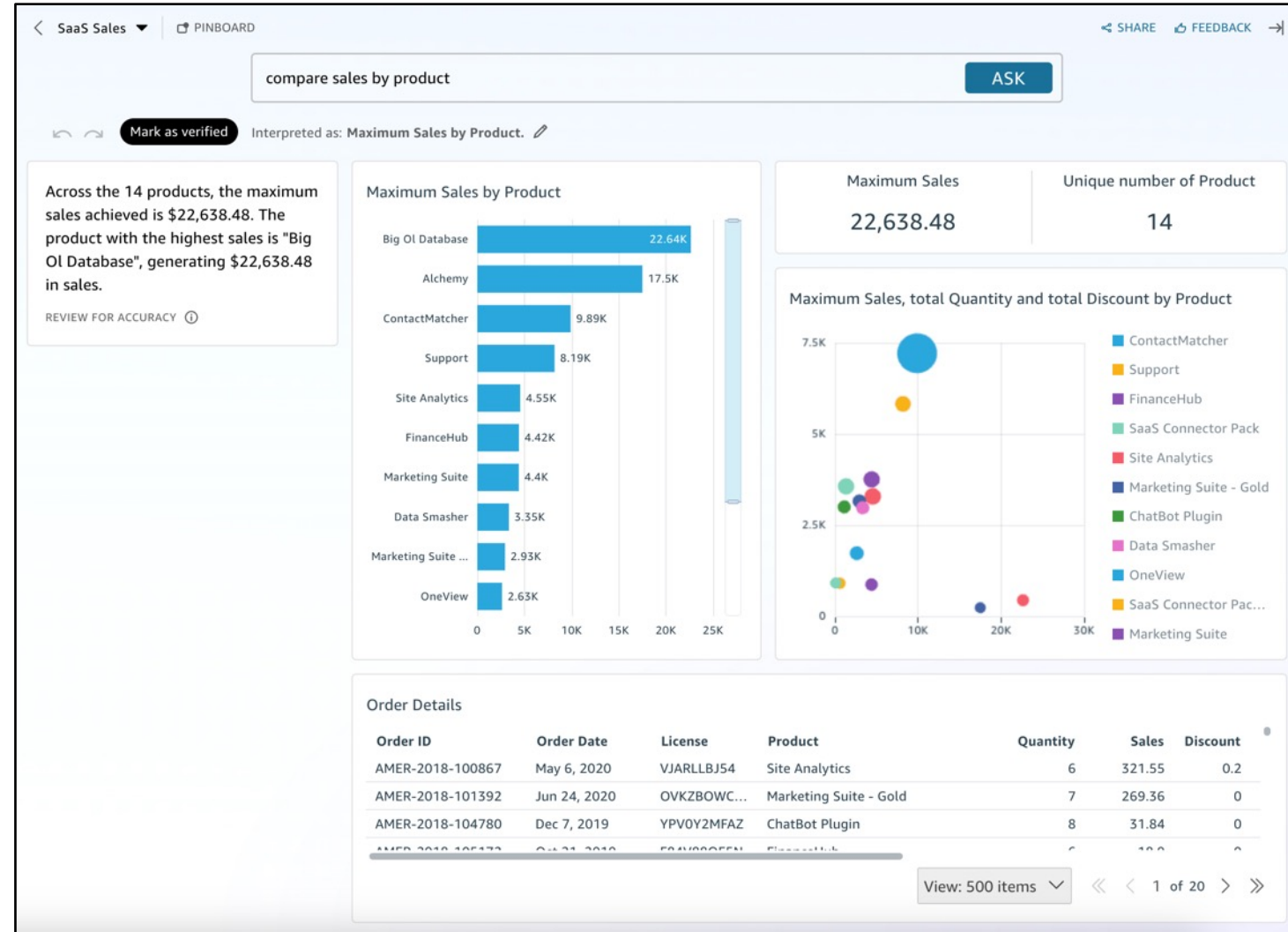
Instant summaries of key dashboard insights in natural language explaining top movers, outliers, and more

## Powerful Q&A for nonexperts

Suggested questions and “what’s in my data” show what can be asked

Multivisual answers with narrative insight summaries explain answer context

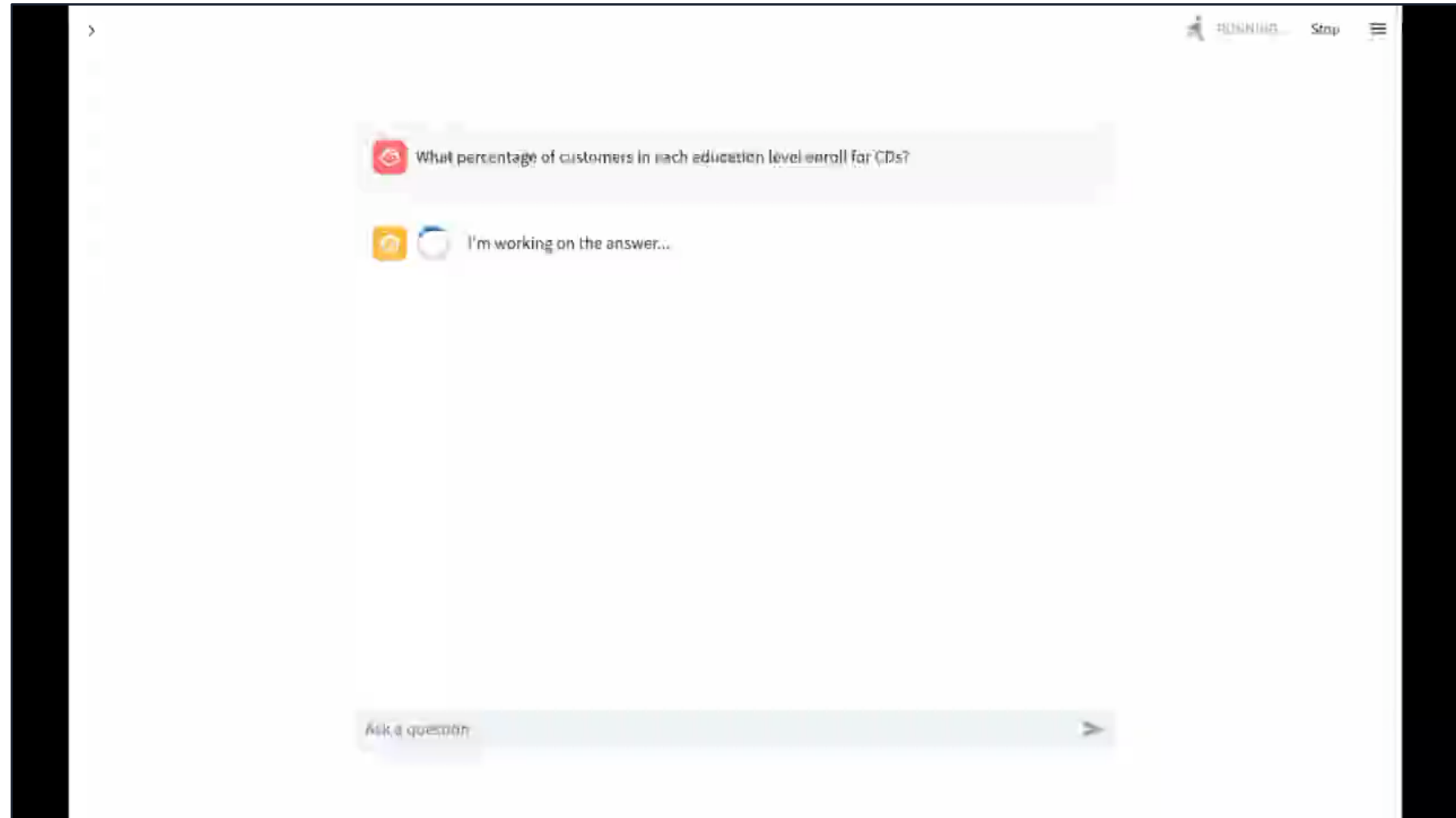
Support for vague questions and “did you mean” alternatives enable iterative fact-finding



# Demo - GenAI Text to SQL

This market research assistant utilizes a modern data architecture and generative AI techniques to empower an organization's market research efforts.

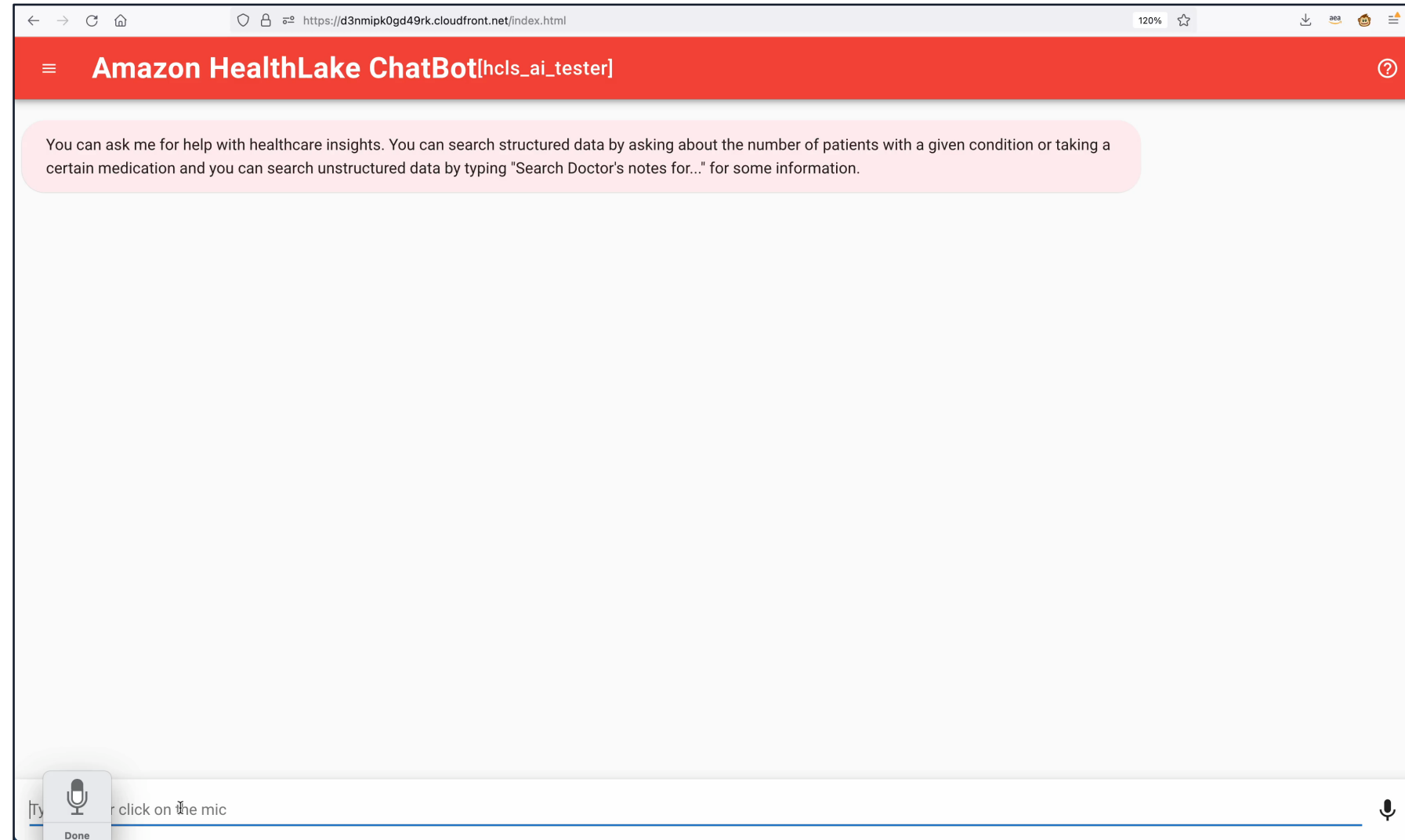
By integrating various data sources and leveraging natural language capabilities, the assistant allows non-technical users to easily query and analyze market research data using conversational natural language.



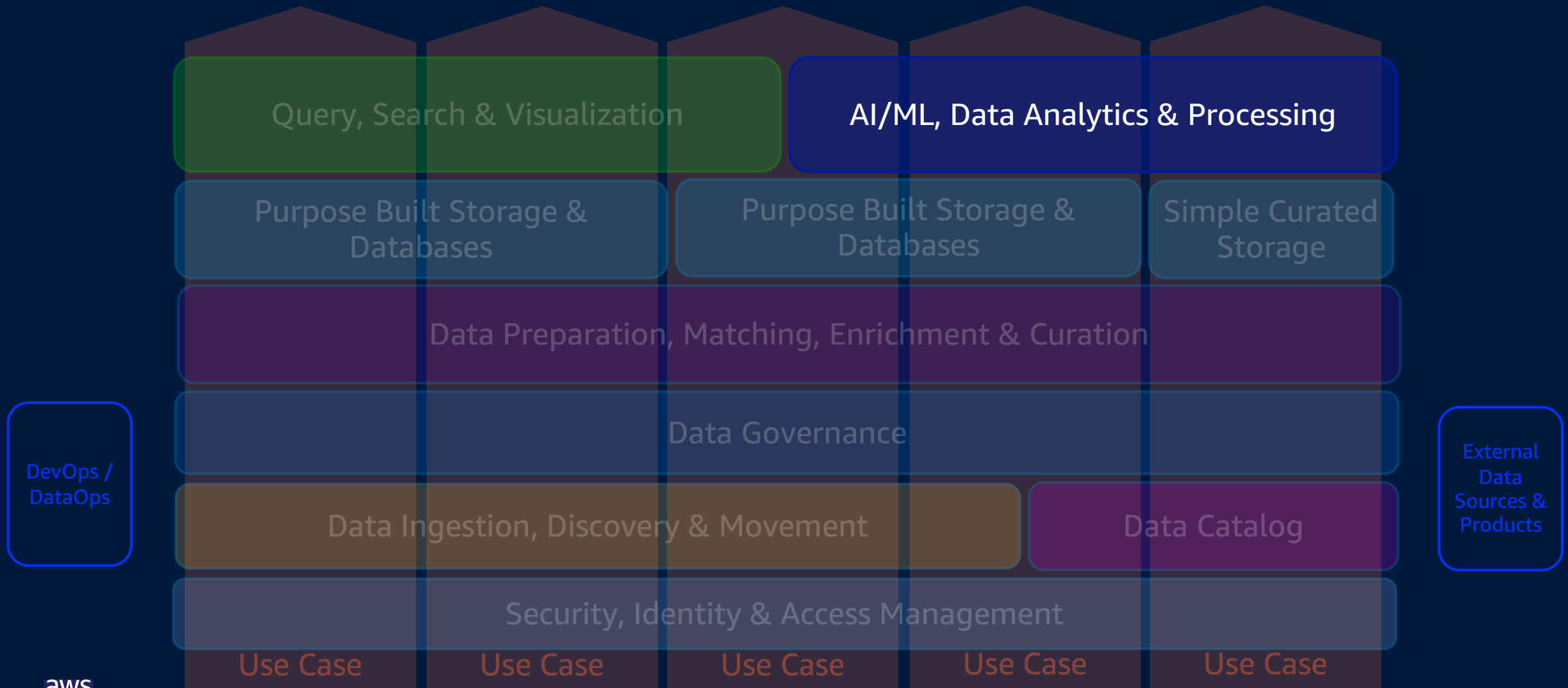
# Demo – Conversationally Interact with EHR Data

By combining HealthLake with a large language model, healthcare providers can interact conversationally with their data, gaining insights and making decisions faster than ever before.

One way to use a large language model with HealthLake is through a chatbot interface. Users can ask questions about both their structured data (e.g., Electronic Health Records (EHR)) or their unstructured data (e.g., doctor's notes).



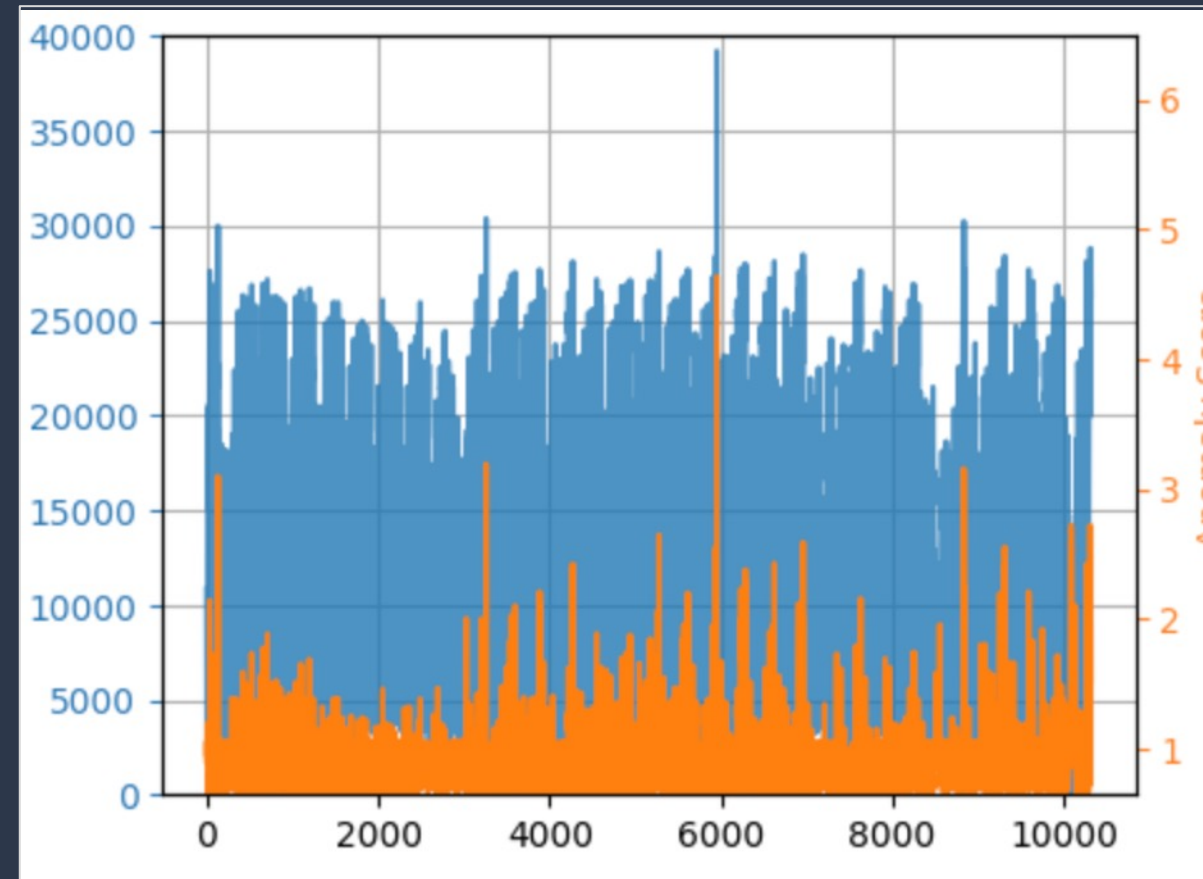
# A Modern, Foundational Data Architecture



# Fraud detection and prevention

## Detect and prevent fraud, waste, and abuse

- Enhance accuracy and speed to help detect and prevent waste fraud and abuse
- Managed service approach with prebuilt ML models for fraud detection
- Supervised and unsupervised models for developing highly targeted models to utilize customer data as part of fraud prevention efforts



# Predictions and forecasts from IoT and sensor data

## Leverage data from smart cities and facilities

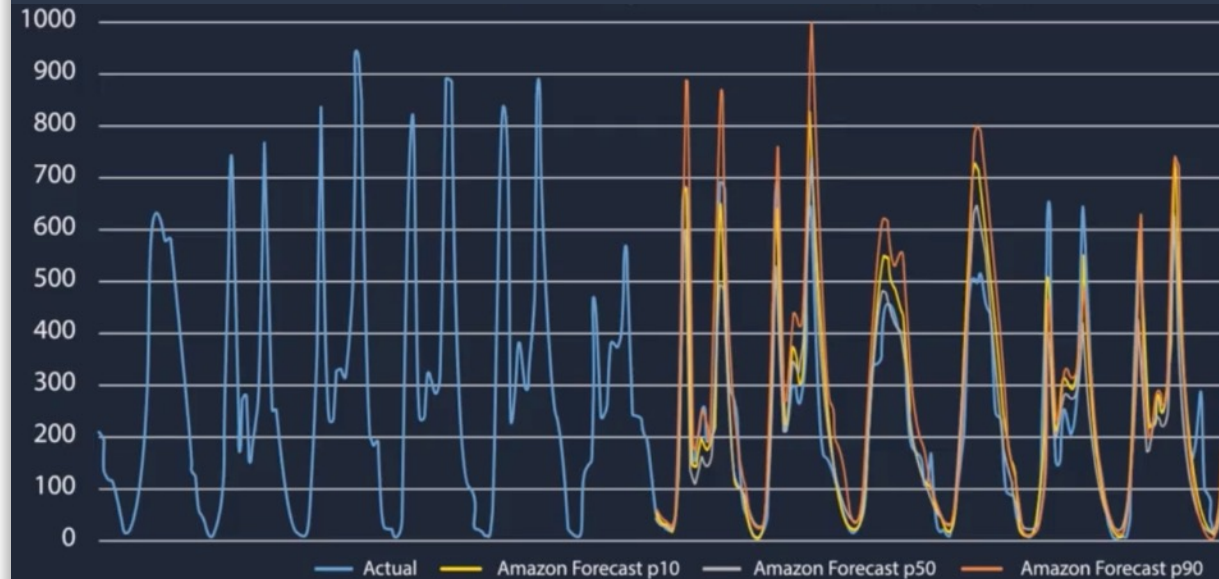
- Smart cities
- Predictive maintenance
- Facility management



# Machine learning to forecast trends and support decisions

## Accurate, time series forecast with machine learning

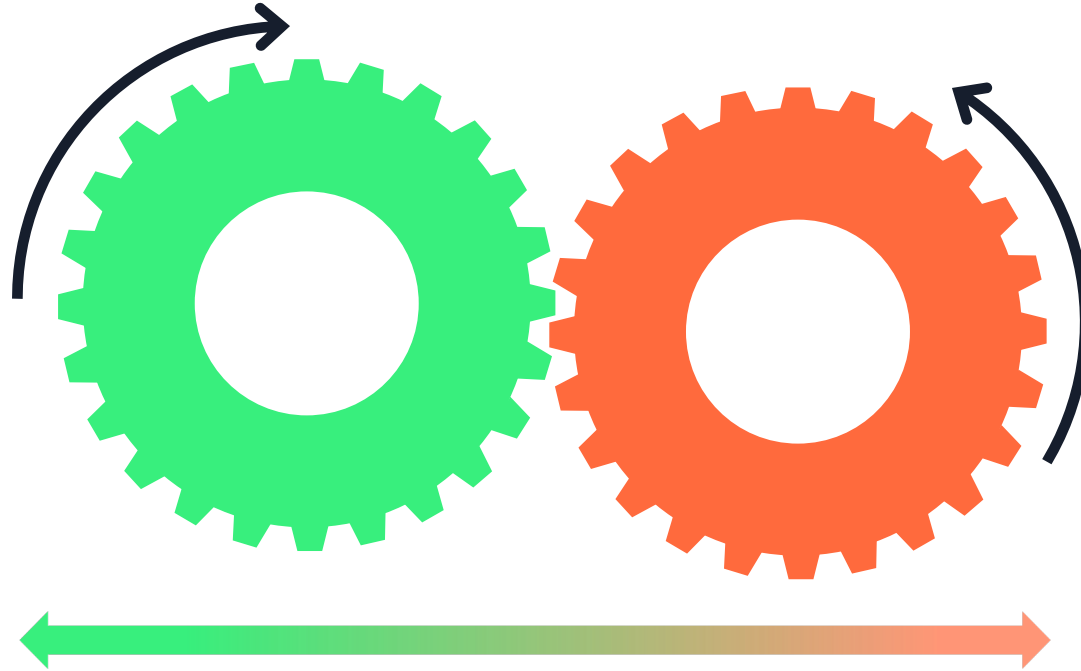
- Predicting service demand or program activities
- Allocating resources to optimize impact and outcomes for citizens
- Financial planning and revenue / cost forecasts



# No Code Predictive Analytics value proposition

## Accelerate data science teams

Do more with your current team by using low-code machine learning tools in order to get to the desired outcomes faster.



## Enable business teams

Give business teams the ability to do ML without any code, scaling the number of people who can create ML powered insights, forecasts, and predictions

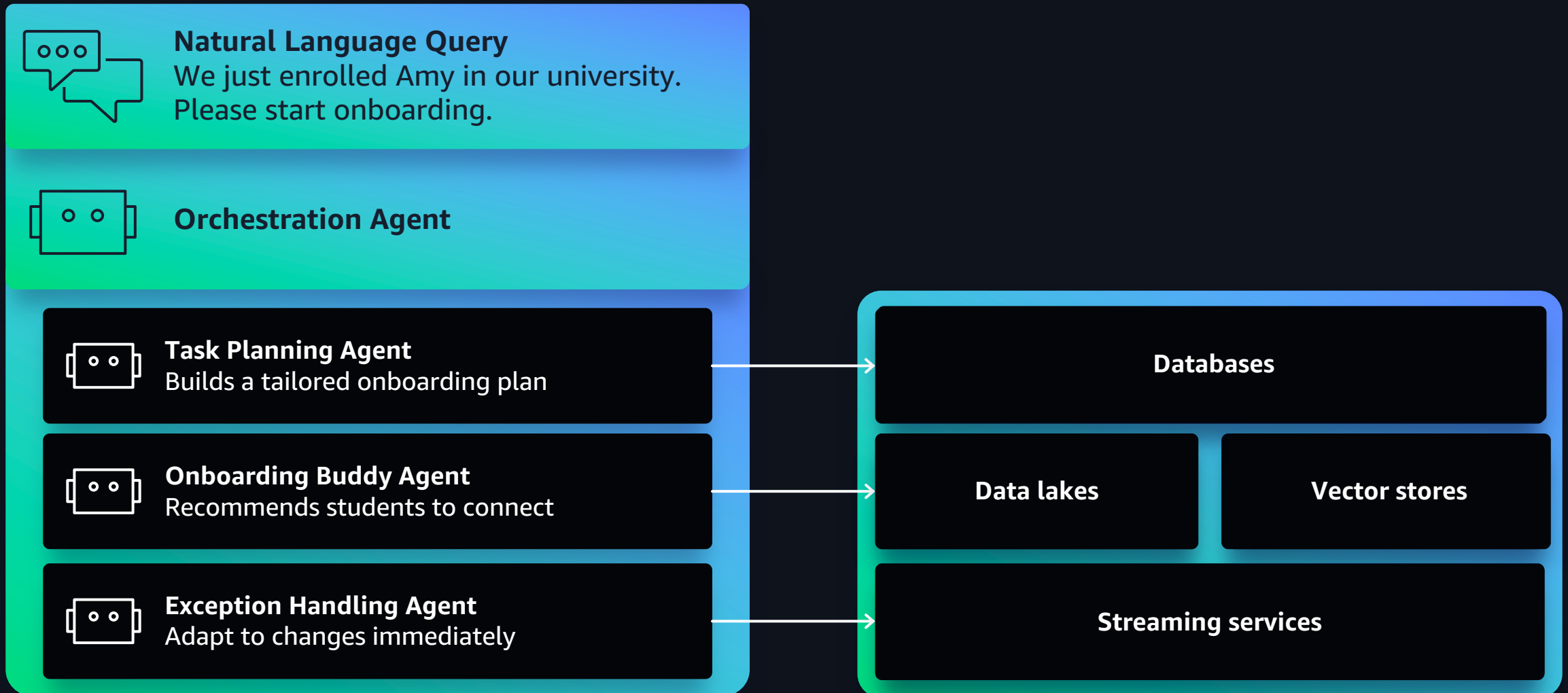
## Collaborate together

Leverage the integrated capabilities of Amazon QuickSight and Amazon SageMaker Canvas making it easy for business users to use machine learning or for data scientists to make changes on the models business users build and creating one place for all the analytics and machine learning in a team or organization.

# What can we do to maximize the opportunities presented by AI/ML and GenAI?

- Develop and begin implementing data modernization strategy & modern data architecture
- Encourage learning & managed experimentation
- Participate in public sector efforts to develop best practices
- Adopt an iterative approach: Think Big, Start Small, Scale Fast

# How data supports your AI applications



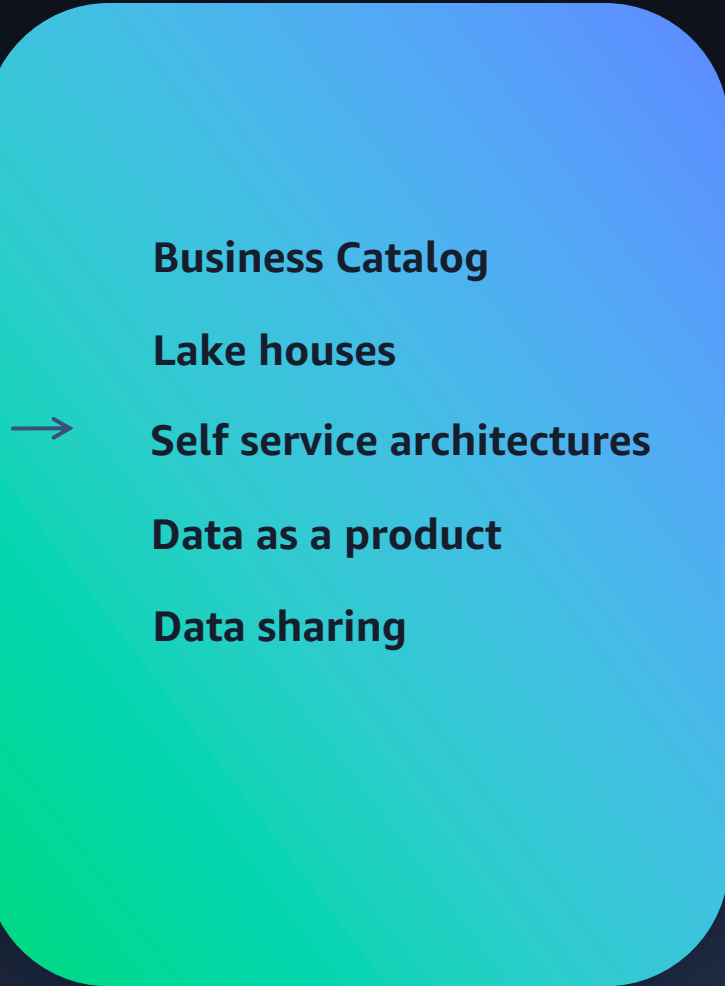
# Extending your data architecture to support genAI and agentic AI

Data lakes











Data warehouses

Databases

## Data Patterns



## Analytics and AI

-  SQL
-  Spark Analytics
-  Model Training
-  Graph and Search
-  Bedrock
-  AgentCore
-  RAG
-  Model Customization
-  Prompt Engineering
-  Agentic workloads

# Amazon Bedrock



## Open source

### Protocols:

MCP, A2A

### Frameworks:

CrewAI, LangGraph,  
Strands Agents



## Amazon Bedrock



### AgentCore



Runtime



Identity



Gateway



Code interpreter



Memory



Browser tool



Observability

### Model Capabilities



Model access



Cost and performance  
optimization



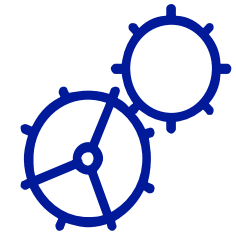
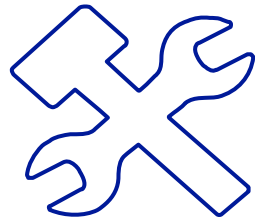
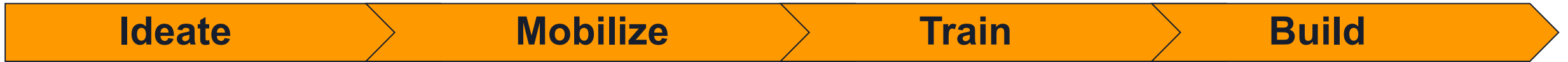
Customization



Guardrails

### Knowledge Bases

# AWS is here to help



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Executive Visioning

Executive Briefing  
Center (EBC)

Digital Innovation (DI)

---

Data-Driven Everything  
(D2E)

Digital & Data  
Transformation (D2T)

---

Immersion Day(s)

ML Embark

Game Days

---

Analytics Acceleration POC

ML Solutions Lab

PACE (POC/MVP)

ProServe or Partner SOW

# Sneak Preview

3:15 pm – 4:15 pm

**200**  
level

Breakout: Transforming Public Sector Analytics and AI/ML workloads with Amazon SageMaker Unified Studio

*Includes a demo...!*



THE NEXT GENERATION OF



# Amazon SageMaker

---

The center for all your data, analytics, and AI

## Unified Studio

COMING SOON

AVAILABLE  
NOW

COMING SOON

### SQL analytics

Amazon Redshift  
Amazon Athena

### Data processing

Amazon EMR  
AWS Glue

### Model development

Amazon SageMaker AI

### Gen AI App development

Amazon Bedrock

### Streaming

Amazon MSK  
Amazon Kinesis

### Business intelligence

Amazon QuickSight

### Search analytics

Amazon OpenSearch  
Service

## Data & AI Governance

## Open Lakehouse



# Thank you!

Archit Malpure

Solutions Architect  
Amazon Web Services  
malpurea@amazon.com



Aditya Challa (Adi)

Sr. Solutions Architect  
Amazon Web Services  
aditchal@amazon.com



## Up Next in this Room

1:30pm – 3:00pm

**200**  
level

**Workshop: The Power  
of GenAI in Data  
Transformation and  
Visualization**

Please complete the survey  
for this session



**Track: Data & Analytics**

Session: AI/ML for Data and  
Analytics