

AWS re:Invent

NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

Unlock the value of your data with AWS analytics

G2 Krishnamoorthy

VP of AWS Analytics
AWS

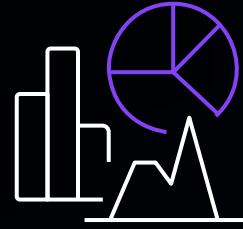
Scott Donaldson

CTO
FINRA CAT

Saurabh Mehta

Observability Engineering Lead
Airbnb



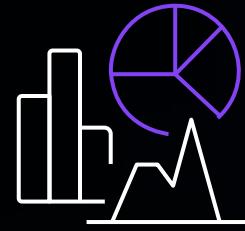


Data growth is remarkable

90%

of today's data has
been created in the last
2 years alone

Statistic provided by [Worldwide IDC Global DataSphere Forecast, 2022–2026](#)



Driving value
from data
is hard

Only
32%
of companies reported that
they are **able to realize value**
from data

Statistic provided by an [Accenture study](#)

AWS is making it easier to unlock the value of data across the end-to-end data journey



SCALABLE
Performance
at scale



UNIFIED
Connect to
all your data



COMPREHENSIVE
Tools for all
your workloads



GOVERNED
End-to-end
governance

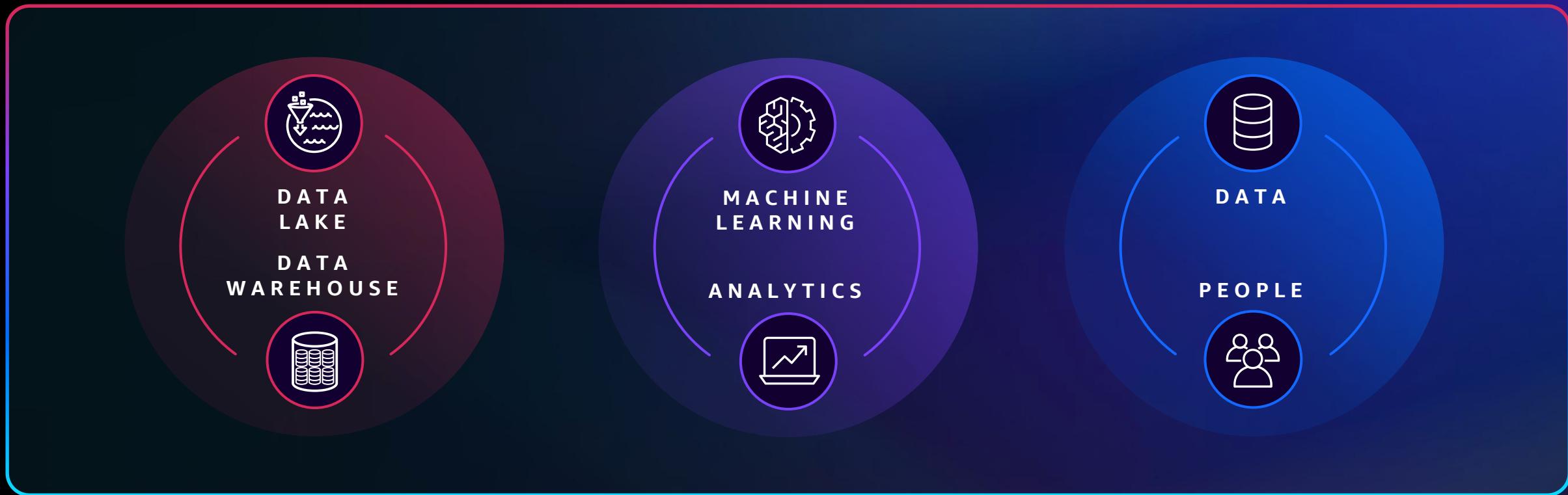


Data fuels innovation in the digital age

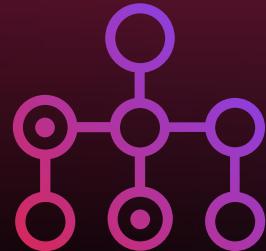
ORGANIZATIONS THAT
ARE GOING TO SUCCEED
WILL BE THE ONES
USING DATA

Breaking down silos

AWS CAN HELP



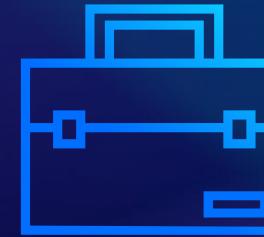
Build a data-driven organization



Data is an
organizational asset



Data is accessible
and secure



Data is put
to work

OCTANK CEO



Octank
Corporation

"What product category
should we invest in?"



FINANCE



SUPPLY
CHAIN



MARKETING



PRODUCT



SALES



DATA
TEAM

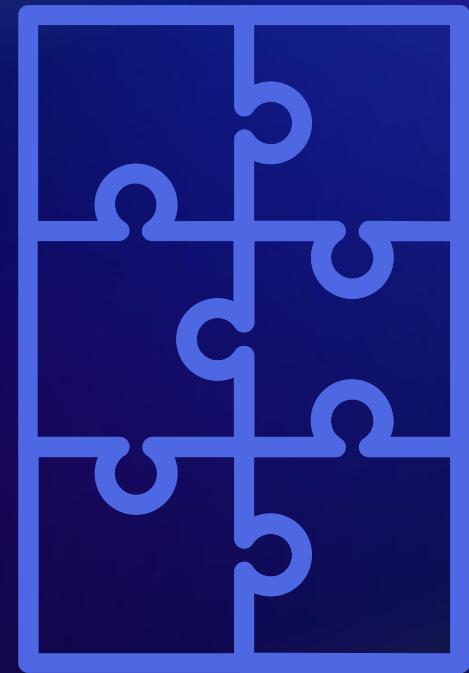
OCTANK CEO



Octank
Corporation



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Technology, process, and business challenges



Octank
Corporation



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We don't have money for
new infrastructure projects



FINANCE

I need approval to use customer
data for this project?



PRODUCT

How do I export my
Salesforce data for analysis



SALES

How do I combine my data
with my supplier's data?



SUPPLY CHAIN



MARKETING

How to analyze Amazon product
reviews, TikTok mentions?

So much data, where do we
store it?
Data lake or data
warehouse?



DATA TEAM

**AWS is here to help
We meet you where you are**



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Make data work for you



Systems



Data



People

JPMorgan Chase

200-year-old financial institution with holdings of approximately **\$3.2 trillion**

\$6 trillion in daily payment

250K employees, **600** applications, **35,000** developers, **450PB** of data stored on S3, and **54 million** digital active customers



160,000 employees, **40** business units
in **70** countries

Built a **Common Data Hub** in AWS
and over **1,000** projects

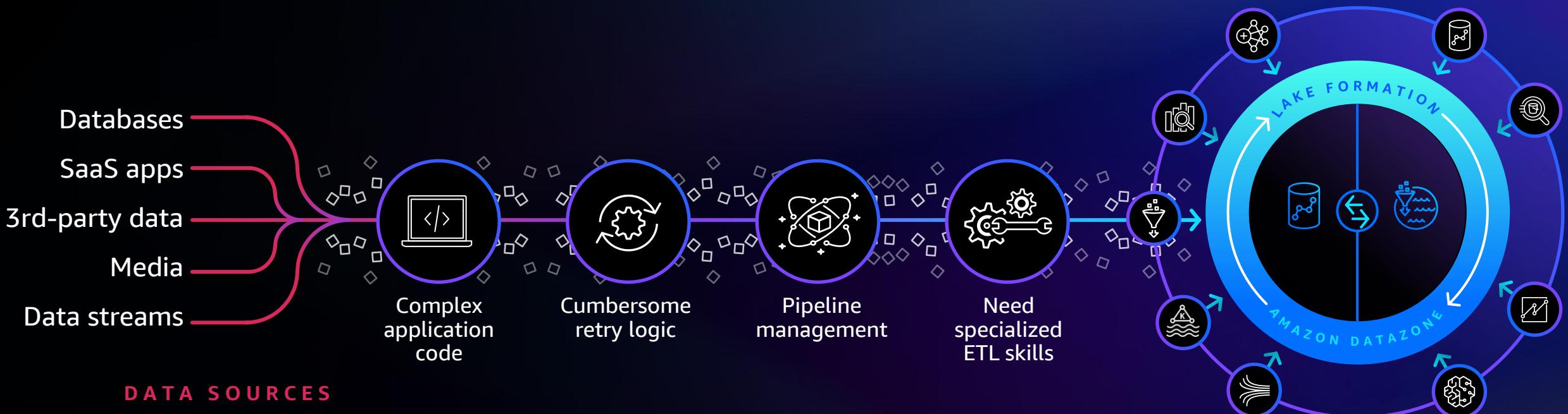
Automated energy predictions

Maximized **wind farm**
energy production

End-to-end data journey



ETL (extract, transform, load) is HARD



AWS Glue

Simple, scalable,
and serverless



Integrate data faster



Automate at scale



No servers to manage



Built on Spark
and Python



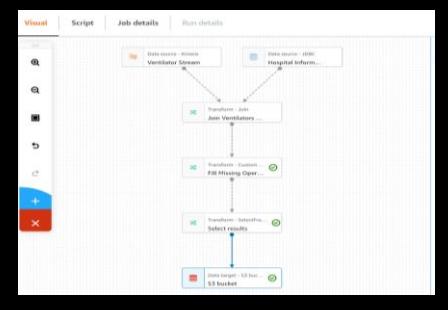
ETL developer



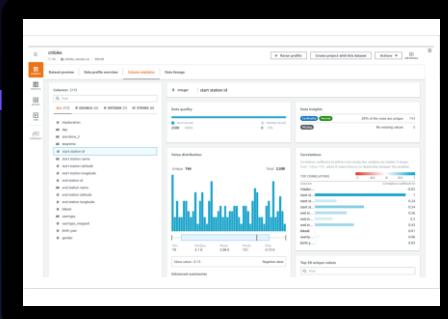
Business analyst



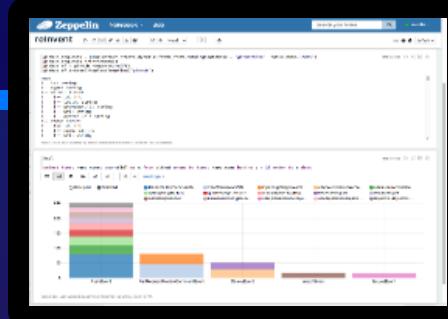
Data engineer



AWS GLUE STUDIO



AWS GLUE DATABREW

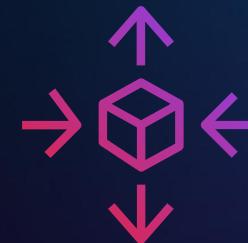


AWS GLUE NOTEBOOKS

NEW**[PREVIEW]**

AWS Glue for Ray

Easy-to-scale Ray
open-source Python
framework, made serverless



Scale existing Python code in AWS Glue for Ray



No infrastructure management or tuning



Cost-effective to scale with pay-as-you-go billing

zero-ETL



NEW

[GA]

Amazon Redshift streaming ingestion

Ingest streaming data into your data warehouse for real-time analytics



NEW

[PREVIEW]

Amazon Aurora zero-ETL to Amazon Redshift

Boost analytical
query performance



No ETL pipelines



Real-time analytics and machine
learning on transactional data



Consolidated insights from
multiple Aurora databases

You also need to
bring data from
SaaS applications



FINANCE



SUPPLY
CHAIN



MARKETING



PRODUCT



SALES



servicenow

Marketo
An Adobe Company

Adobe

Kendesk

salesforce

Zero-ETL

Amazon AppFlow

Automate data flows by securely integrating third-party applications & AWS services, without code



Easy to use



Cost-effective



Reduce operational burden



Secure and scalable

Amazon AppFlow supports over 50 applications

INCLUDING SALESFORCE, SAP, AND GOOGLE ANALYTICS

Zero-ETL

MARKETING CONNECTORS

- Facebook Ads*
- Facebook Page Insights
- Google Ads*
- Google Search Console
- Instagram Ads
- LinkedIn Ads

CUSTOMER SERVICE AND ENGAGEMENT CONNECTORS

- Mailchimp
- SendGrid
- Zendesk Sell*
- Zendesk Chat*
- Freshdesk
- Okta
- Typeform

AS WELL AS

- Stripe
- Amazon RDS for PostgreSQL
- QuickBooks Online
- Jira Cloud*
- GitHub

AND MORE!

* Launched in 2022 prior to re:Invent



SUBSCRIBER BENEFITS

Quickly find diverse data in one place



Easily analyze data as it's published



Spend less time and effort to use data in production



AWS Data Exchange

3,500+ public data products from **300+** data providers



Secure private sharing with your partners



Automatic entitlement, billing, and payment management



AWS Data Exchange is fully integrated with Amazon Redshift data sharing



Find and subscribe to **third-party data**

No data copies or movement

Automated **licensing** and contracting

Secure and **governed collaboration** with your partners

Federated query in Amazon Redshift and Amazon Athena

Zero-ETL

Integrate operational database with data warehouse and Amazon S3 data lake

Analytics on operational data **without data movement** and ETL delays

Flexible and easy way to ingest data, avoiding complex ETL pipelines

Azure
Data Lake Storage



Azure Synapse



Google
BigQuery



HORTONWORKS

Microsoft
SQL Server



ORACLE



redis

SAP HANA

snowflake

teradata.

TPC VERTICA



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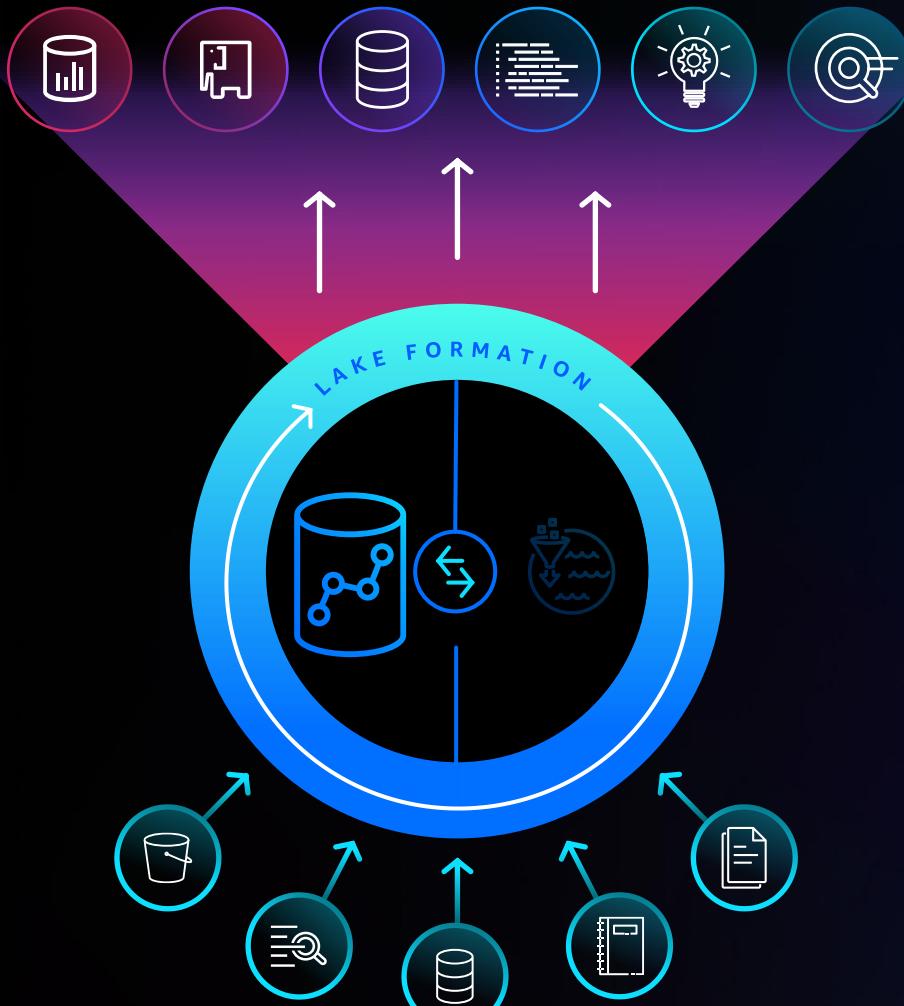
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Breaking down data silos

"What product category should we invest in?"



Amazon Redshift: Your data warehouse foundation



Store your data in **high-performance format**

Cost-effectively **scale storage** to exabytes

Decouple storage from compute

Support for **ACID transactions**

Choice of analytical and ML engines

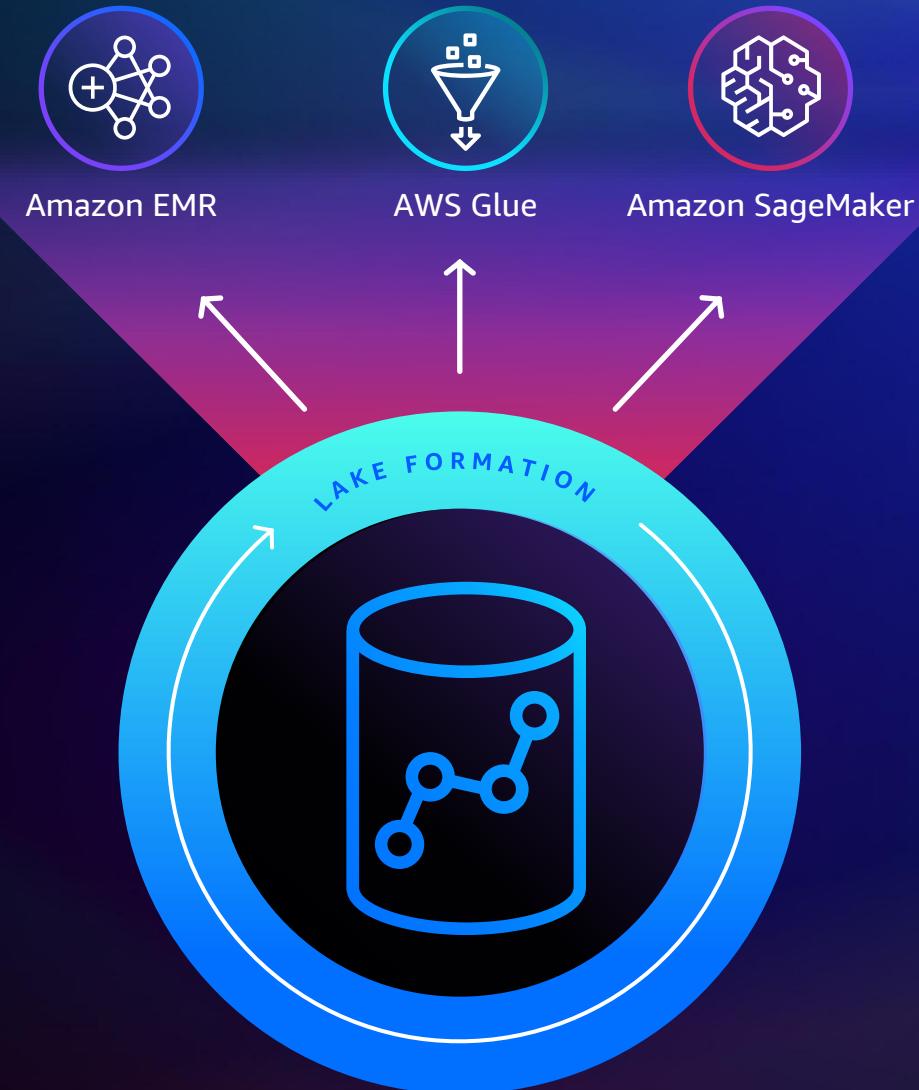
NEW

NEW

[GA]

Amazon Redshift integration for Apache Spark

Simplify and speed up Apache Spark applications accessing Amazon Redshift data from AWS analytics services





E Q U I N O X

FINANCIAL TIMES



Goldman
Sachs



H E A R S T



intuit

Johnson & Johnson



Kimberly-Clark

Tens of thousands of customers analyze exabytes
of data every day on Amazon Redshift

Klarna.

LexisNexis



MERCK

moderna

nextgen
healthcare

ORION

PELOTON

Pinterest

playrix



Prezi

QANTAS

redhill
GAMES

robinhood



SCHOLASTIC

SONY



Sysco

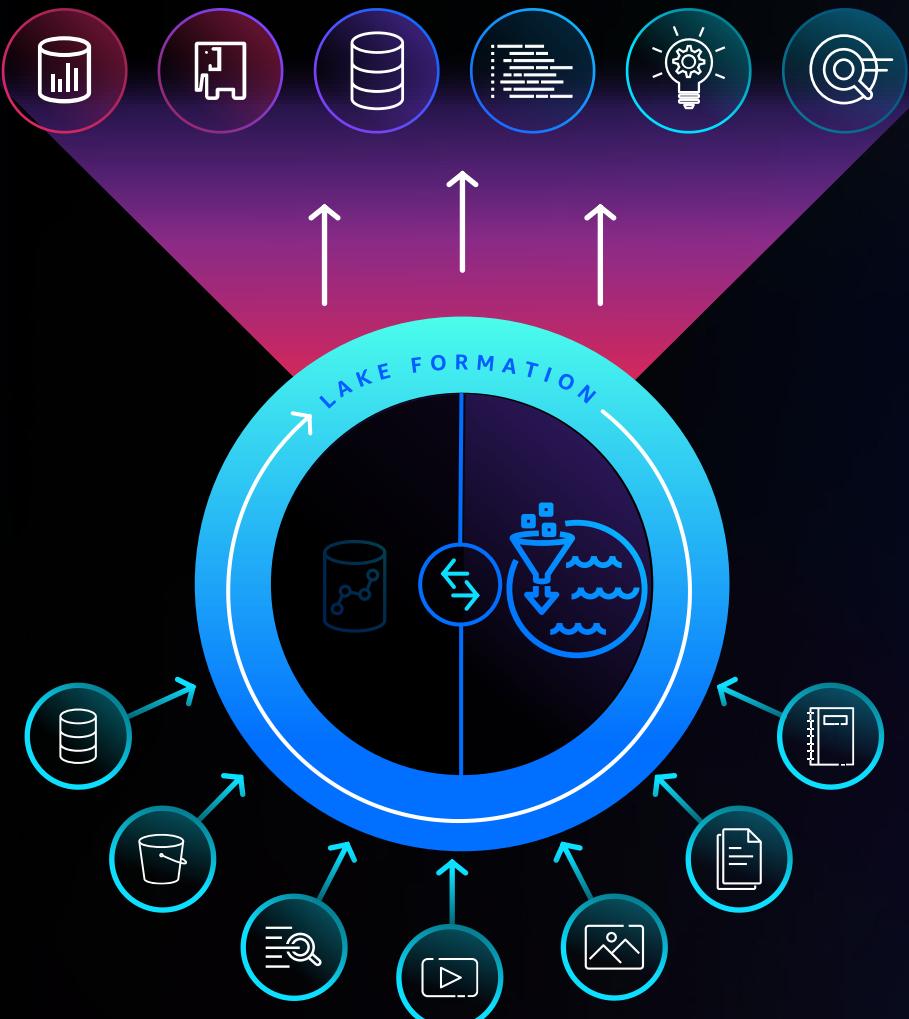


yelp

zynga



The benefits of data lakes



Store all your data in **open formats**

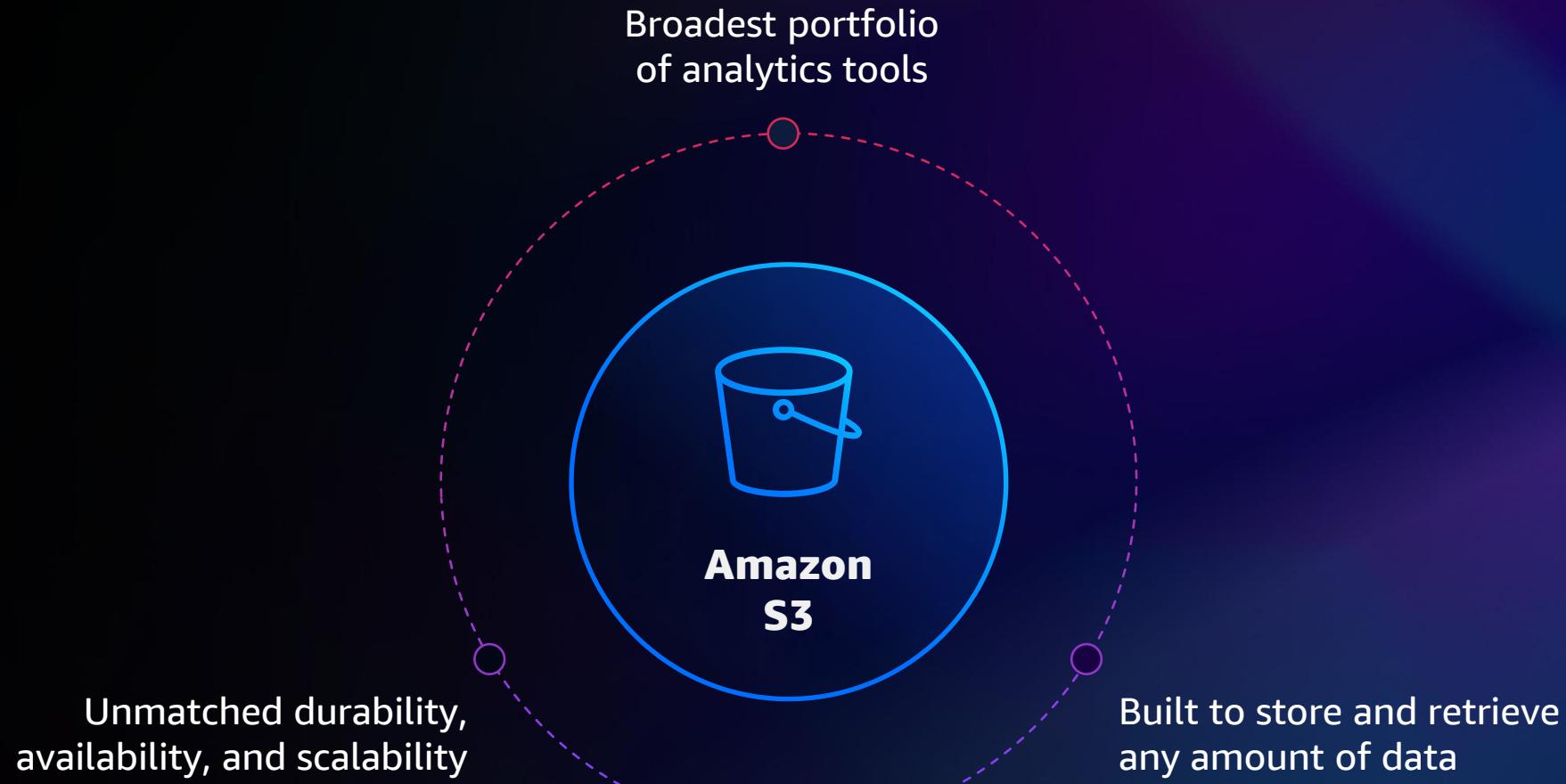
Cost-effectively **scale storage** to exabytes

Decouple storage from compute

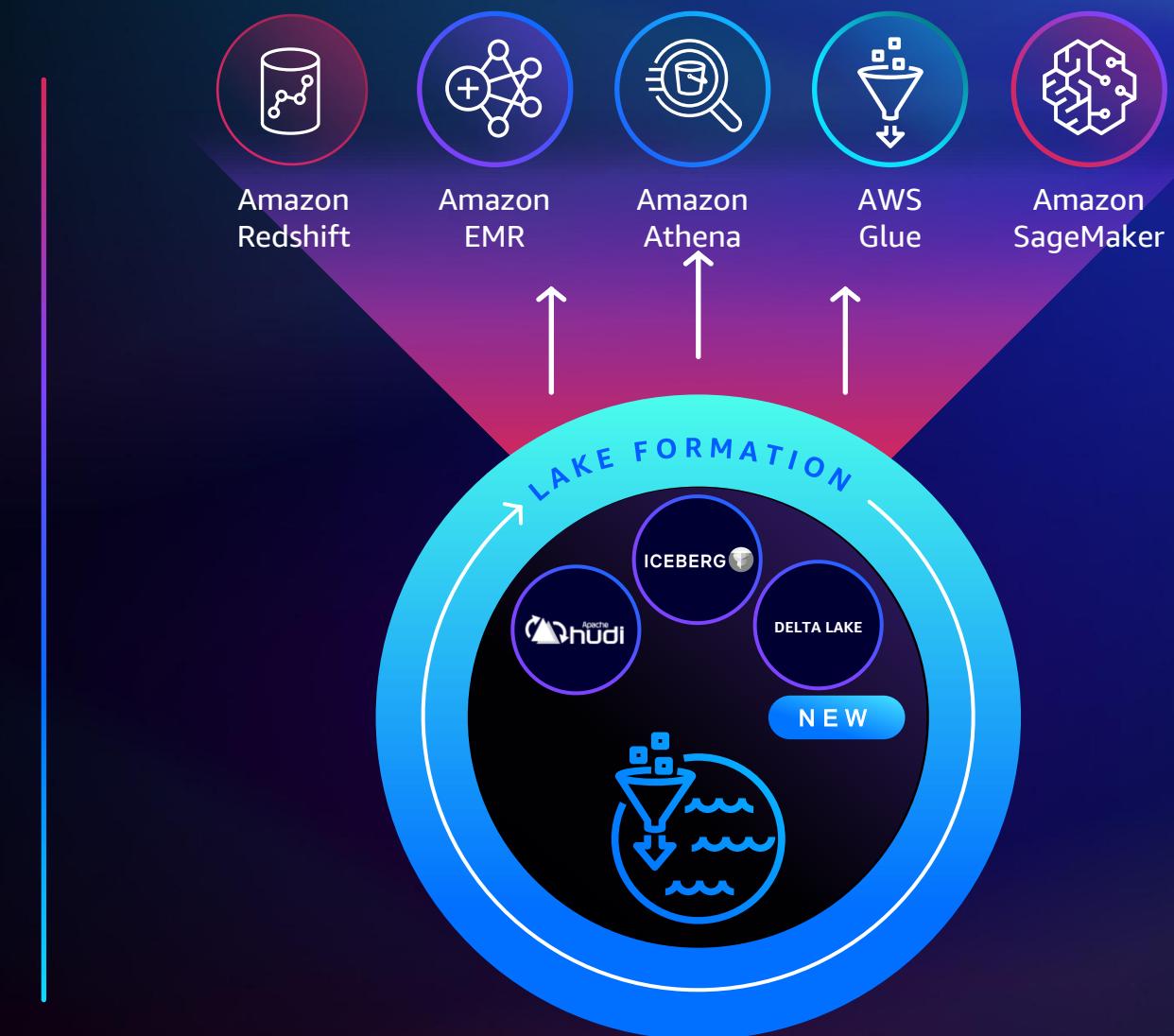
Choice of analytical and ML engines

Process data **in place**

Amazon S3: Your storage foundation for data lakes



Broad support for transactional data lakes





AMGEN

ANA

BMW
GROUP

CHANGE
HEALTHCARE

COMCAST

Continental

coursera

DATADOG

Discovery

duolingo



engie



expedia group



Fannie Mae

FICO



FOURSQUARE



Goldman
Sachs

GRUBHUB

Inchcape

INNOVMD

intuit

INVISTA

ironSource

Hundreds of thousands of data lakes run on AWS

Klarna

Liberty Mutual
INSURANCE

mercado
libre

MOVABLE
INK

New Relic

docomo

NuData Security

OLX

PADDYPOWER.

PennyMac
Correspondent

Pinterest

REDFIN

robinhood

ROBLOX

salesforce.org

SIEMENS

slack

Snap Inc.

Sysco

theTradeDesk

TOYOTA

Vanguard

vyaire
MEDICAL

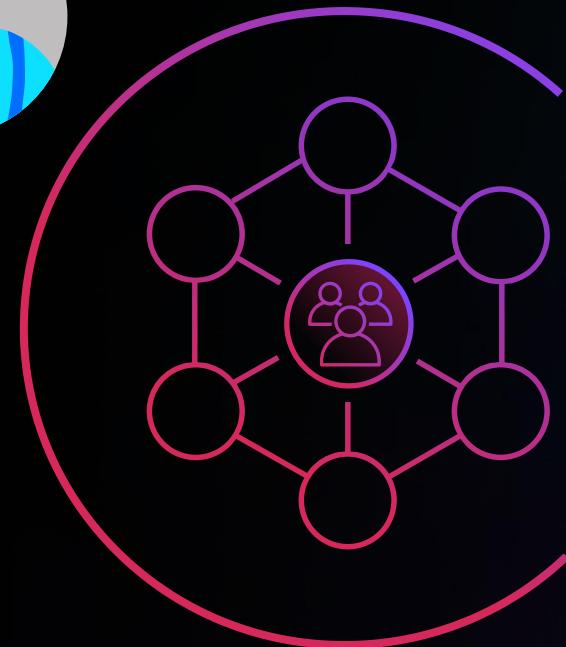
yelp

Zillow

ZipRecruiter



Sales



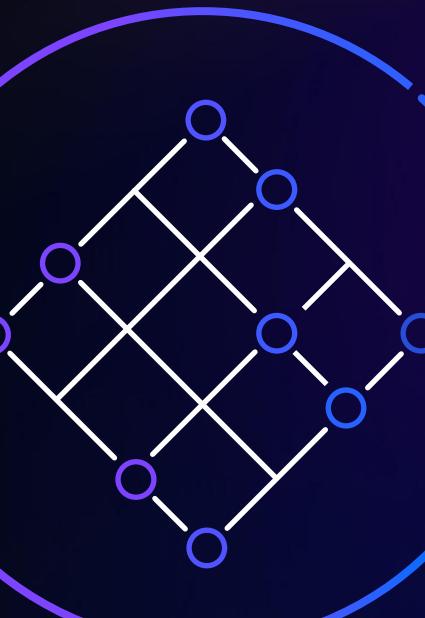
**DATA
PRODUCERS**

Finance



**DATA
CONSUMERS**

Marketing



DATA MESH



Governance is key

Unified governance for analytics and machine learning



Centralized
policies



Consistent
enforcement



Audit
trail

AWS Lake Formation

Govern, secure, and share data in data lakes and data warehouses



Centralize access control policies



Enforce policies across all services



Define fine-grained access permissions



Simplify access management



Enhanced integrations with Amazon Redshift, EMR, SageMaker, & Athena

NEW





Sales



Finance



Marketing

NEW

[COMING SOON]

Amazon DataZone

Unlock data across organizational boundaries with built-in governance



Manage **organization-wide governance** in one place



Catalog your data with business context



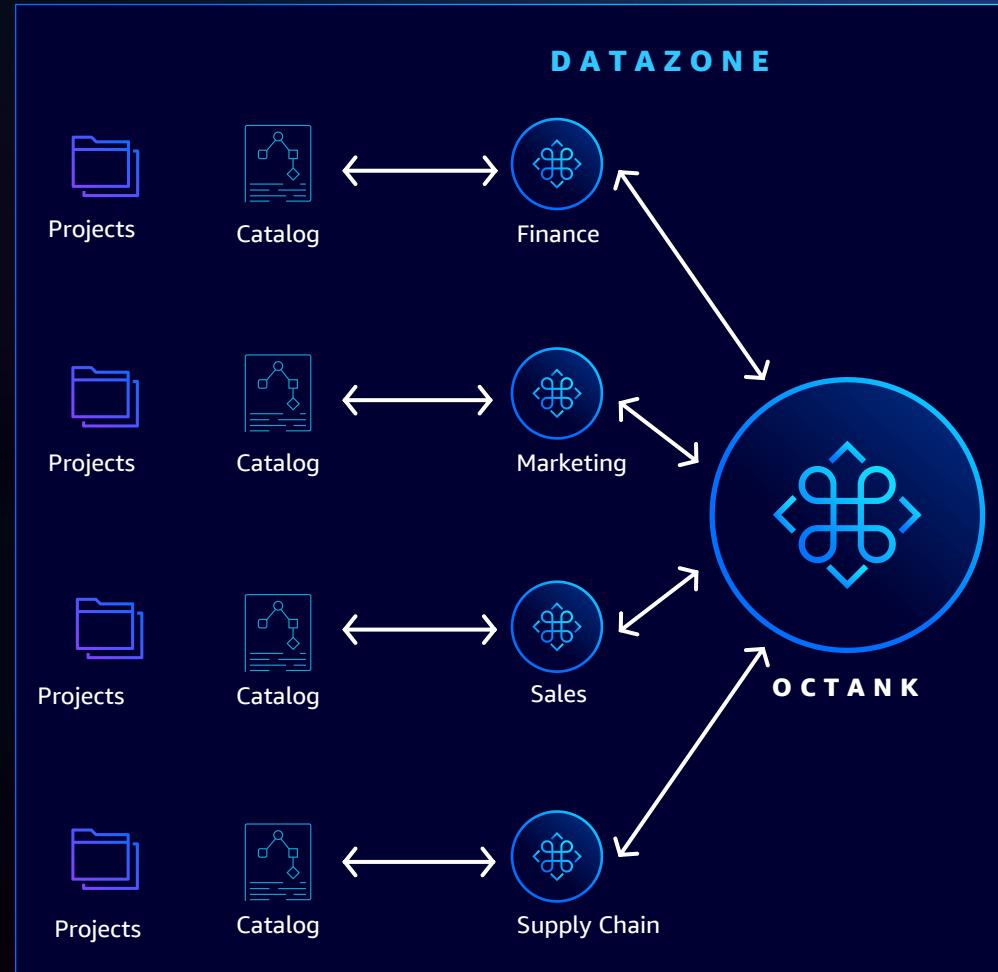
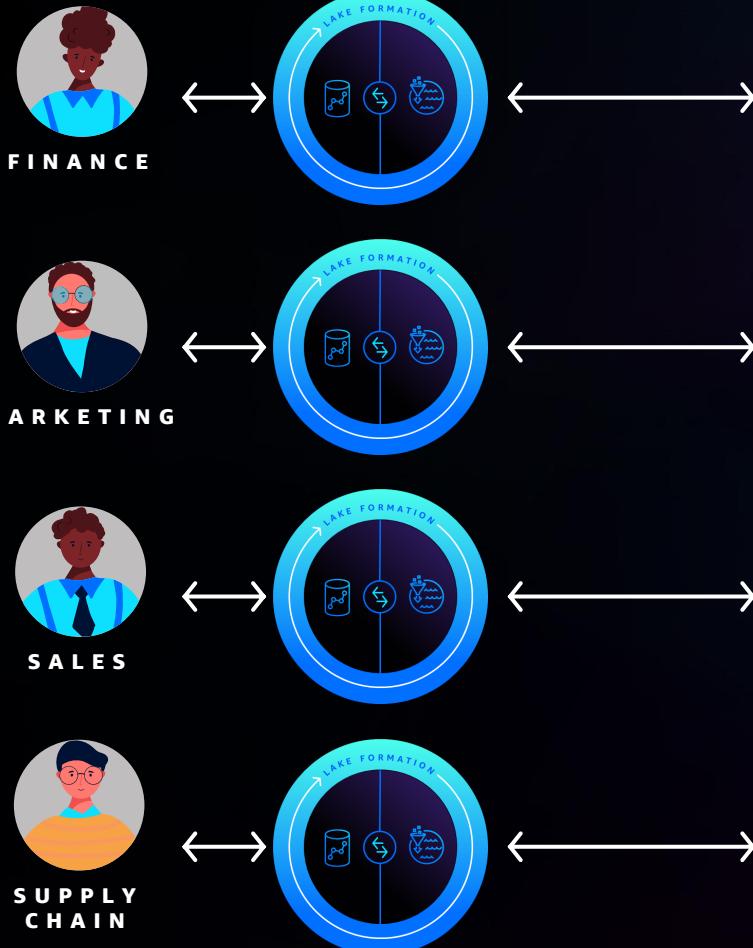
Simplify access to analytics for everyone in your organization



Solve specific business use cases through **data projects**

Build your data mesh with Amazon DataZone

REMOVE THE UNDIFFERENTIATED HEAVY LIFTING



"What product category should we invest in?"



The FINRA logo is displayed in a large, white, sans-serif font. The letters are bold and slightly slanted to the right. The background behind the text is a dark blue rectangle with a thin white border.

Scott Donaldson

Chief Technology Officer, Vice President

Who are we?

610B+ peak market events
500B+ average market events
130K+ files processed/day



620K+ brokers,
3700 broker-dealer
firms regulated



32 exchanges



FINRA

Dedicated to investor
protection and
market integrity

2 trillion+ data
validations per day



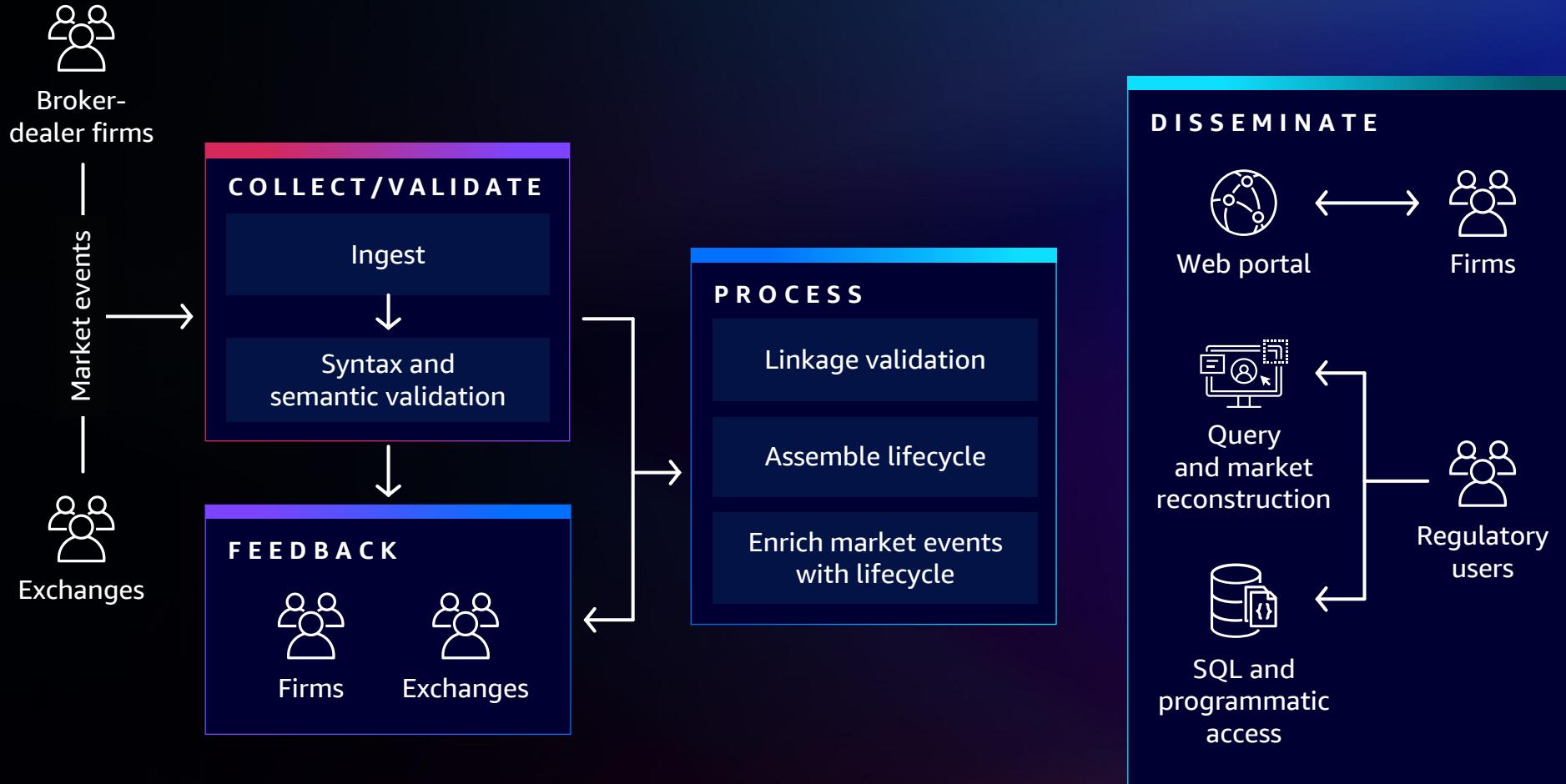
150K+ compute instance/day,
9,000+ Amazon EMR clusters/day



500+ petabytes of
storage managed



Consolidated Audit Trail (CAT) overview



CAT challenges



PERFORMANCE

CAT has an aggressive requirements and SLAs requiring it link 1 trillion+ market events and report the errors to firms and exchanges



SCALABILITY

CAT application must be scalable to highly fluctuating market volumes



SIMPLICITY AND AVAILABILITY

Simple, ubiquitous access to complicated data sets and reporting scenarios to multiple regulatory organizations

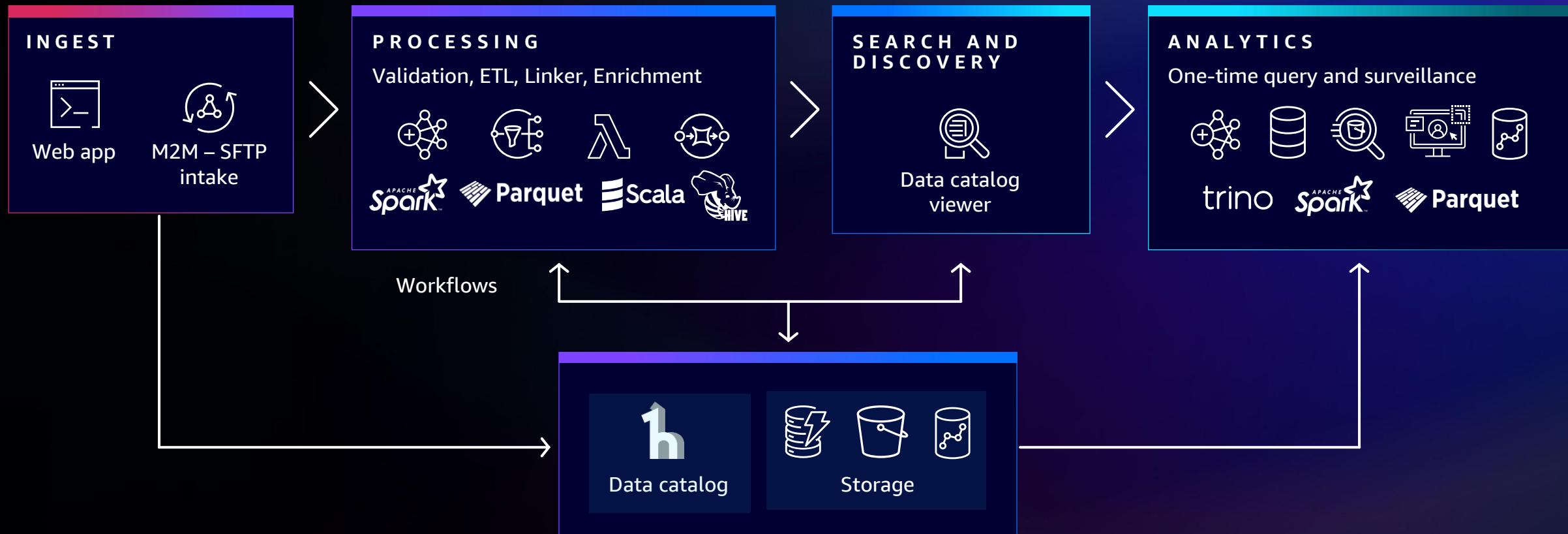


COST

As the market volumes increase, compute and storage cost also increase

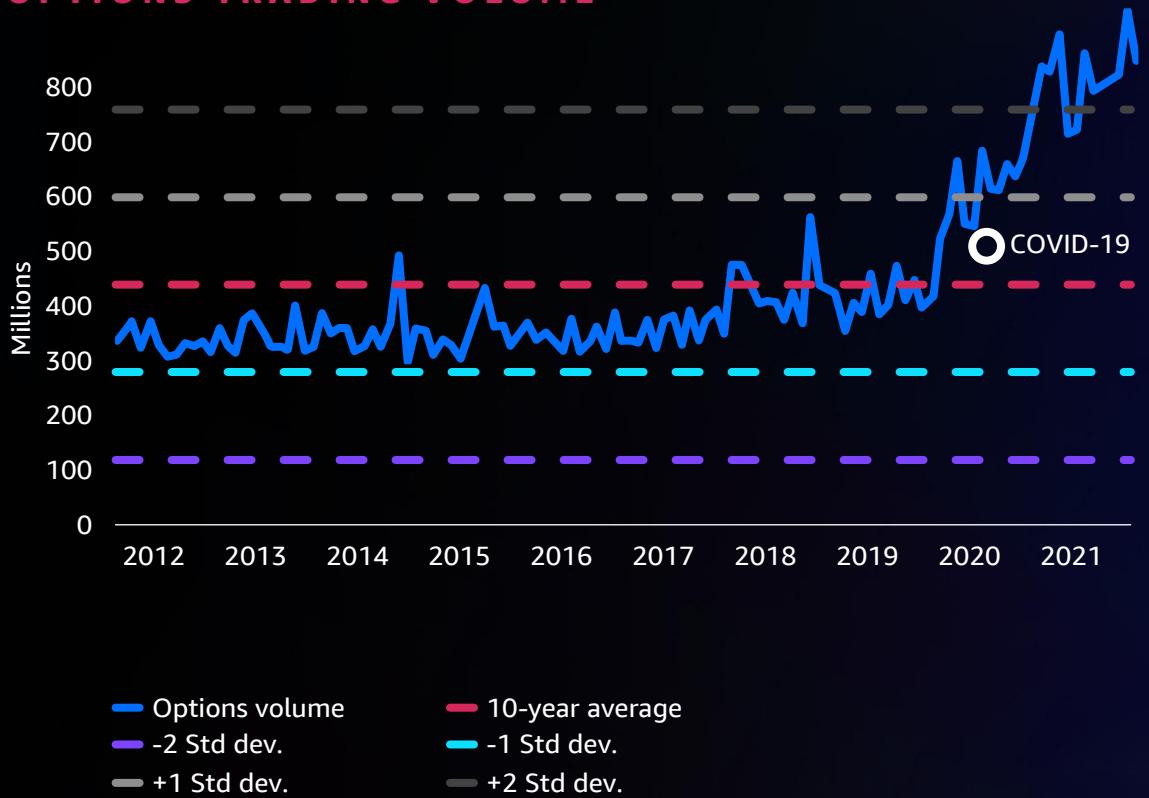
Improve efficiency by optimizing the performance of all the jobs

Analytics processing at extreme scale



Equity and options trading volumes over the last 10 years

OPTIONS TRADING VOLUME



Starting in 2019, equity and options trading volumes shifted higher by a significant magnitude: equity (**+62%**) and options (**+100%**) markets from 2019 to 2021¹

CAT by the numbers

500B

events/day

250T

processing trillions of
events in 2022

10x

projected growth of
data volumes

120K

compute nodes/day

450 PB

overall data stored
is up 3x

Effective cost management

25–30%

results were better
than expected

>50%

actual reductions

66%

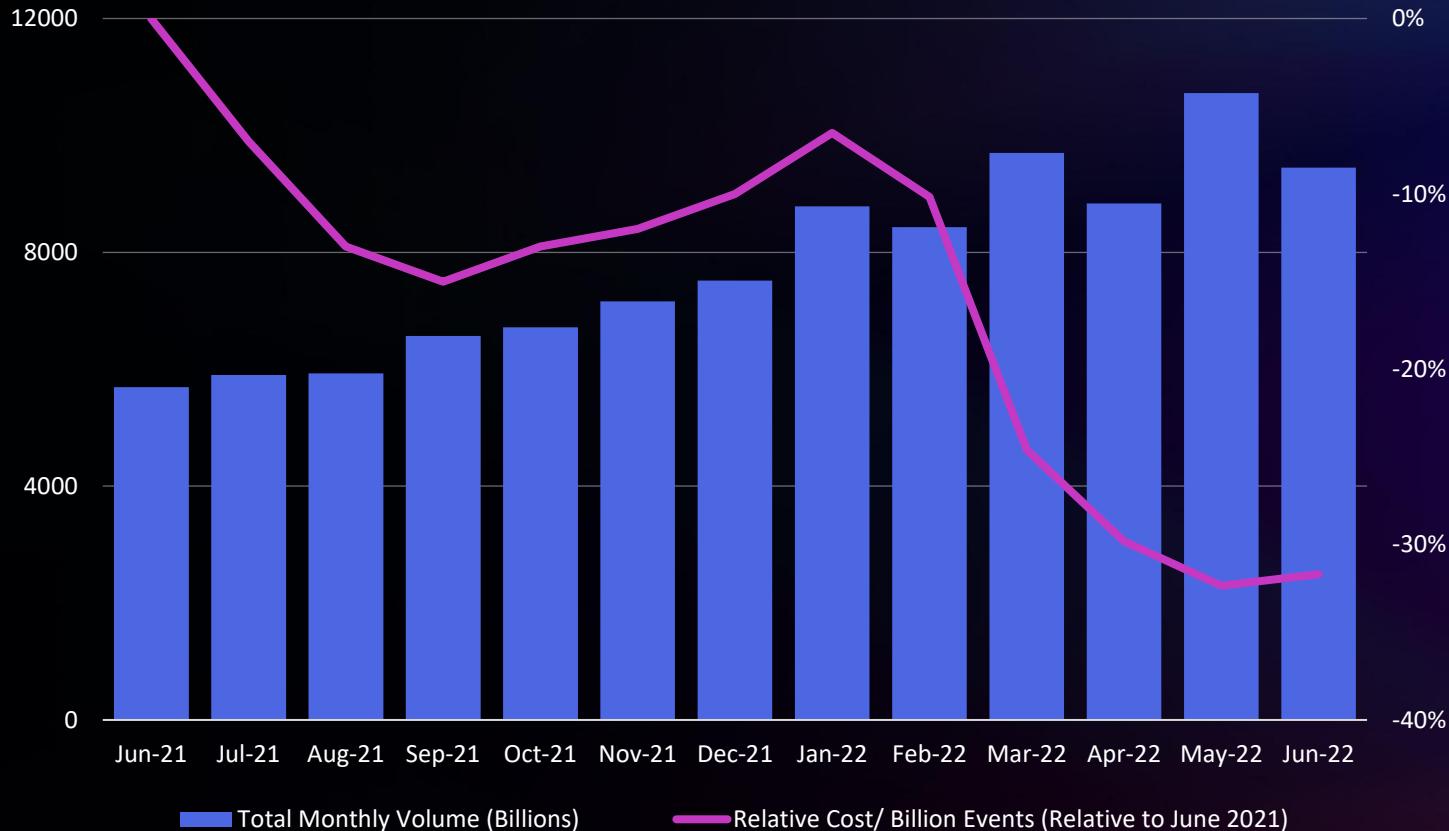
reduced cluster
node count

400

reduced from 1,200
nodes

The impact

RELATIVE COMPUTE COST/BILLION EVENTS (RELATIVE TO JUNE 2021)



While data volumes increased by over **2x**

Performance went up by **3x**

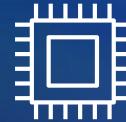
Cost to process 1 billion events is down by **33%**

Overall AWS fees have only grown by **<25%**

What's next for CAT



Amazon EMR on
Amazon EKS



AWS Graviton3 adaption to
improve price performance



Amazon EMR 6.x/Apache Spark 3.2
upgrade and explore push-based
shuffle service



Data scalability with Apache Iceberg



Athena cross-account access with
Lake Formation



Adapt GP3 Amazon EBS volumes
for better performance and cost

The broadest set of analytics services

SERVERLESS



AMAZON
REDSHIFT

SERVERLESS



AMAZON
ATHENA

SERVERLESS



AMAZON
EMR

SERVERLESS



AMAZON
OPENSEARCH
SERVICE

NEW

SERVERLESS



AMAZON KINESIS
& AMAZON MSK

SERVERLESS



AMAZON
QUICKSIGHT

SQL analytics

Interactive
analytics

Big data
processing

Log and
search analytics

Real-time
analytics

Business
intelligence

Amazon Redshift

SQL analytics at scale



Best price performance
at any scale



Analyze **all your data**



Easy, **secure, and reliable**

Up to
5X
better price
performance

TPC-DS and TPC-H out-of-the-box
3 TB benchmark

OUT-OF-THE-BOX PRICE PERFORMANCE (LOWER IS BETTER)

(On 3 TB Benchmark derived from TPC-DS)

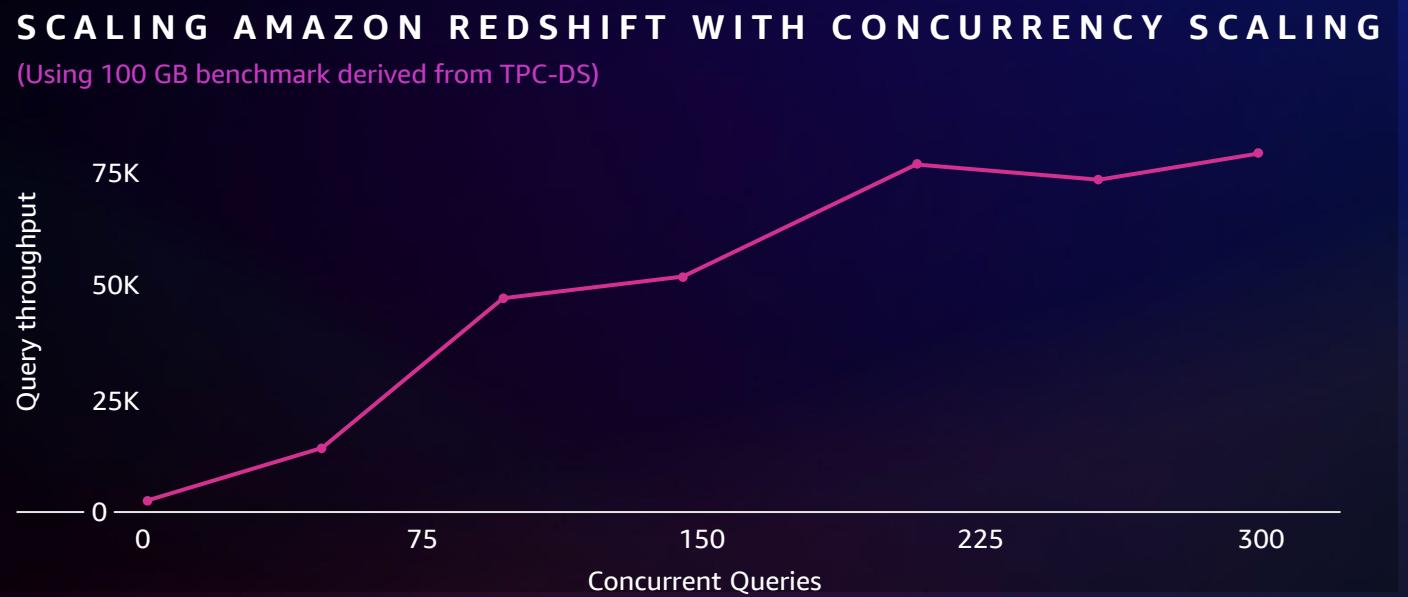
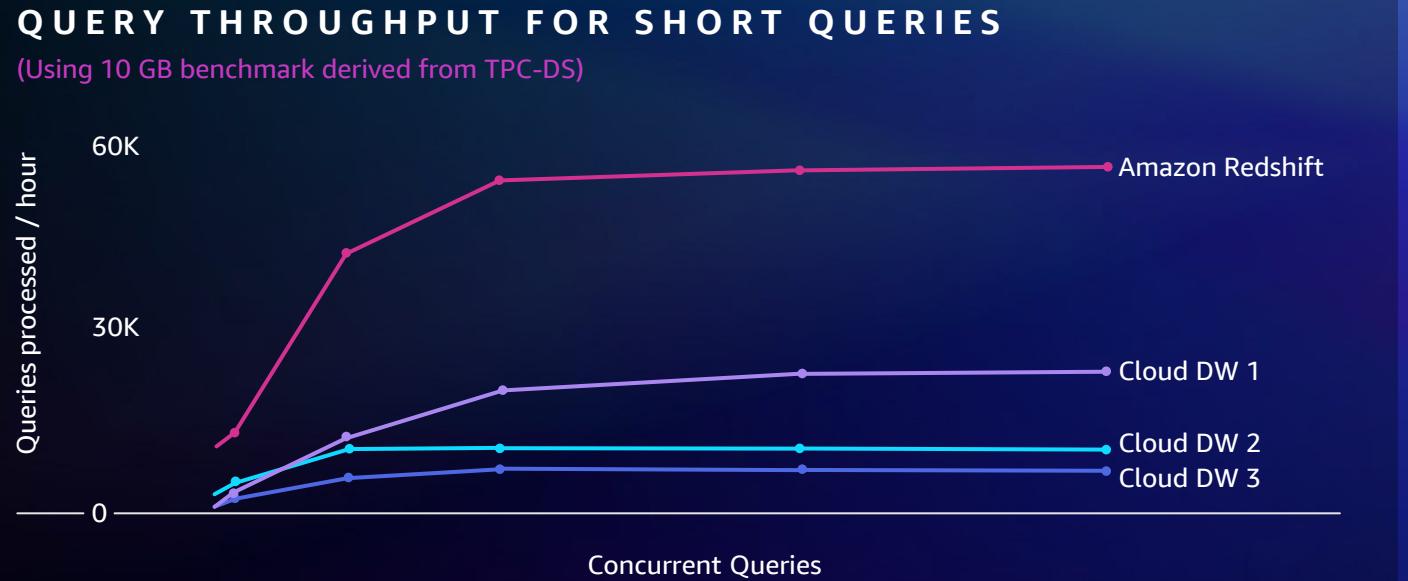


OUT-OF-THE-BOX PRICE PERFORMANCE (LOWER IS BETTER)

(On 3 TB Benchmark derived from TPC-H)



Up to
7X
better price
performance for
BI dashboards



Amazon Athena

Interactive analytics for all your data – built on open source



Simple and **serverless**



Flexible connectivity



Open and standard formats



Cost-effective

Athena SQL engine v3 benefits

NOW AVAILABLE

FASTER QUERIES AND MORE FREQUENT UPDATES

50

New SQL functions built
on up-to-date Trino

90+

Enhancements to engine
behaviors producing
faster performance

20%

Faster queries at the same
cost with up to 10x faster
query planning

100%

Functional parity with
engine v2 and easy
to upgrade



NEW

[GA]

Amazon Athena for Apache Spark

Interactive analytics with Apache Spark



Start **under a second**



Harness the power of **PySpark**



Simple and **serverless**



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Amazon EMR

Easily run Spark, Hive, Presto, HBase, Flink, and more big data frameworks on AWS



Run the **latest versions** of open-source frameworks

Best price performance for your workloads

Governed access to data lakes and data warehouses

Fully managed, **multiple deployment options**

Differentiated performance

ON SPARK, TRINO, AND HIVE

3.9x

faster than standard
Apache Spark 3.0 in TPC-
DS 3 TB benchmark

4.2x

faster than standard
OSS Trino 388 in TPC-
DS 3 TB benchmarks

11–16%

performance
improvement with
AWS Graviton2 at
20%+ reduced cost

100%

open-source
API compliant

30%

better price
performance with
AWS Graviton 2



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Lowest cost

LOWEST TCO



On premises

COSTS

- Server costs
- Network costs
- IT labor costs
- Extras



EMR

COSTS

- Subscription fee
- Support costs



EMR Optimized

OPTIONS TO CUT COST



EMR Serverless



Community-driven



110M+ downloads



100s of contributors



1,000s of pull requests



40+ open-source partners

Amazon OpenSearch Service

Amazon OpenSearch Service securely unlocks real-time search, monitoring, and analysis of operational data



Optimized managed service: Use a popular open-source solution



Security: Data center and network architecture and built-in certifications



Observability: Detect potential threats and react to a system's state



Increased value: Optimize time and resources

Amazon OpenSearch Service customers

SOFTWARE AND INTERNET



BIOTECH AND PHARMA



FINANCIAL SERVICES



EDUCATION TECHNOLOGY



SOCIAL MEDIA



TELECOMMUNICATIONS



TRAVEL AND TRANSPORTATION



REAL ESTATE



LOGISTICS AND OPERATIONS



PUBLISHING



OTHER





LexisNexis

Received **positive feedback** from
89% of early users

Runs metadata on over **27 million** pieces
of legal content

Reduces manual legal research time

Uses artificial intelligence to provide
recommendations and **strengthen briefs**

Canvases entire knowledge graph in
11 seconds

NEW

[PREVIEW]

Amazon OpenSearch Serverless

Securely unlock real-time
search, monitoring, and analysis
of operational data



No servers to manage



Automatically scales based
on data and queries



Get started in seconds



Pay only for resources used

Amazon MSK and Kinesis Data Analytics

Fully managed streaming data services for your favorite open-source engines



Built on **open-source** Kafka and Flink

Simple to use

Highly available

Pay only for resources used

Flexible scaling for your workloads

Latest innovations

ACROSS AWS STREAMING SERVICES TO MAKE IT EVEN EASIER TO RUN STREAMING DATA WORKLOADS

AMAZON MSK TIERED STORAGE



A low-cost storage tier
that scales to virtually
unlimited storage

KINESIS DATA STREAMS DATA VIEWER



A no-code, interactive explorer
to view streaming data

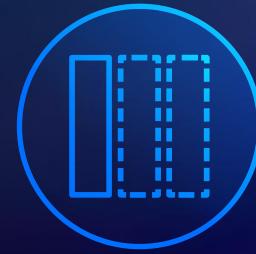
Real-time data analytics use cases



Customer 360



Personalized customer experiences



Real-time notifications



More accurate ML models



Anomaly and fraud detection



Predictive maintenance



IoT and asset management



Security and threat management



airbnb

Saurabh Mehta

Observability Engineering Lead

Fast facts

6M

active listings
worldwide

as of March 31, 2022

100K

cities and towns with
active Airbnb listings

as of March 31, 2022

220+

countries and regions
with Airbnb listings

as of March 31, 2022

1B+

all-time Airbnb
guest arrivals

as of March 31, 2022

4M+

hosts on Airbnb

as of March 31, 2022

\$150B+

earned by hosts,
all-time

as of March 31, 2022

\$13.8K

earned by the typical
US host in 2021

as of March 31, 2022

Business challenges with logging



OPERATIONAL CHALLENGES

- Large pet clusters
- Hard to provision and upgrade
- No capacity management



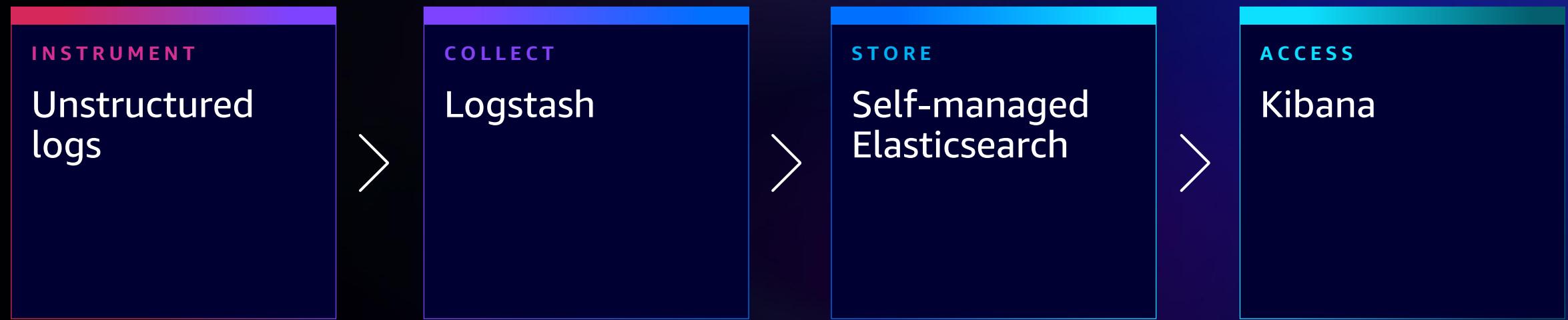
COST

- No tiered storage
- One retention fits all
- No cost attribution
- ~\$1.0/GB*



LOGS GROWING 2X EVERY YEAR

Monolith Logging Architecture with increasing costs



Business requirements for better logging



GROWTH

Many smaller clusters
(cattle)

Automated scaling and
data migration



RELIABILITY

Isolation and quota
enforcement

Automated node
replacement

Regular snapshots



COST EFFICIENT

Tiered storage with
configurable retention

Reduce \$/GB cost



PERFORMANT

Optimized
instance types

Building with Amazon OpenSearch Service and Amazon Kinesis Data Streams



GROWTH

Terraform managed
Provides automated
resizing

Blue/green deploy with
automated data migration



RELIABILITY

Quality of Service

- Isolation and quota enforcement
- Edge processing and filtering

Automation

- Automatically blocks writes
- Automated node replacement
- Hourly snapshots



COST EFFICIENT

Tiered storage option with
Hot, UltraWarm, and Cold

Cost ~\$0.05/GB

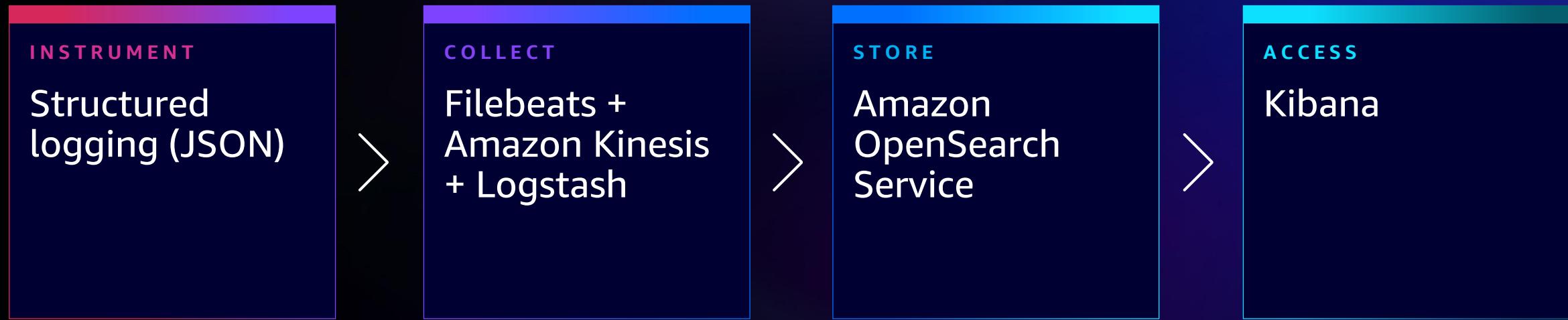


PERFORMANT

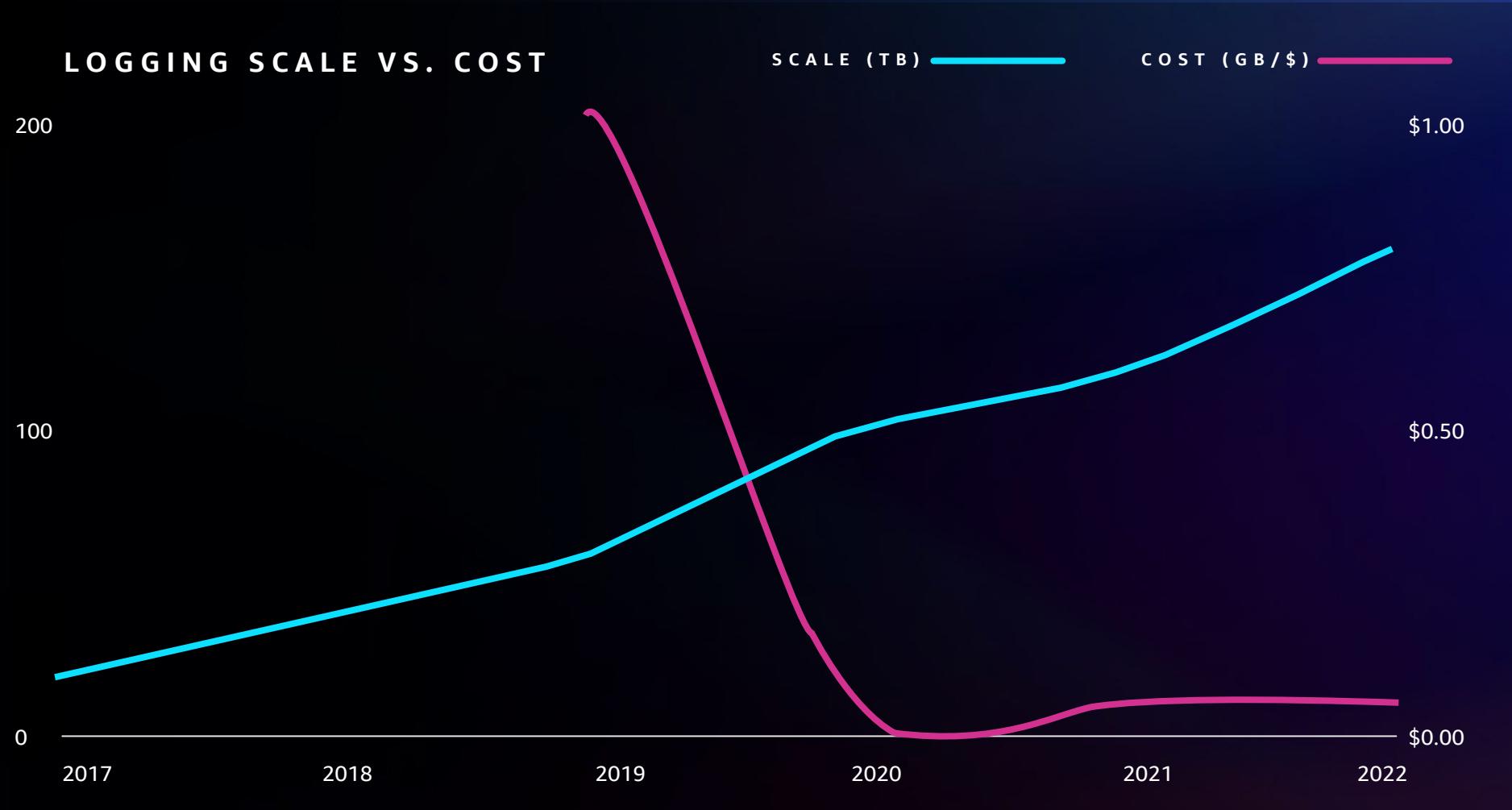
Structured logging –
low chance of index
field explosion

Optimized
instance types

Logging Architecture, cost-optimized for scale



Evolution of logging at Airbnb



Reduced the cost by **4x**

While the data volumes have grown **2x**

Open-source benefits



COMMUNITY

Crowdsourced support
Knowledge sharing



VELOCITY

Future releases
Time to market



TRANSPARENCY

Quality
Extensibility

What's next for Airbnb

OPEN STANDARDS

Open Telemetry
API + SDKs + Collectors

VALUE

Automation

Correlation

Aggregation

ACCESS

Query Language + API + Unified Tooling





ML and analytics: **Closer than ever**

PERFORM DATA ENGINEERING,
ANALYTICS, AND ML IN ONE NOTEBOOK

Amazon SageMaker Studio

AWS brings the power of
analytics to ML users



Built-in data and analytics integration

Connect with Spark, Hive, and Presto on Amazon EMR



Interactive data preparation

Interactively query, analyze, and transform diverse data



Inline debugging and monitoring

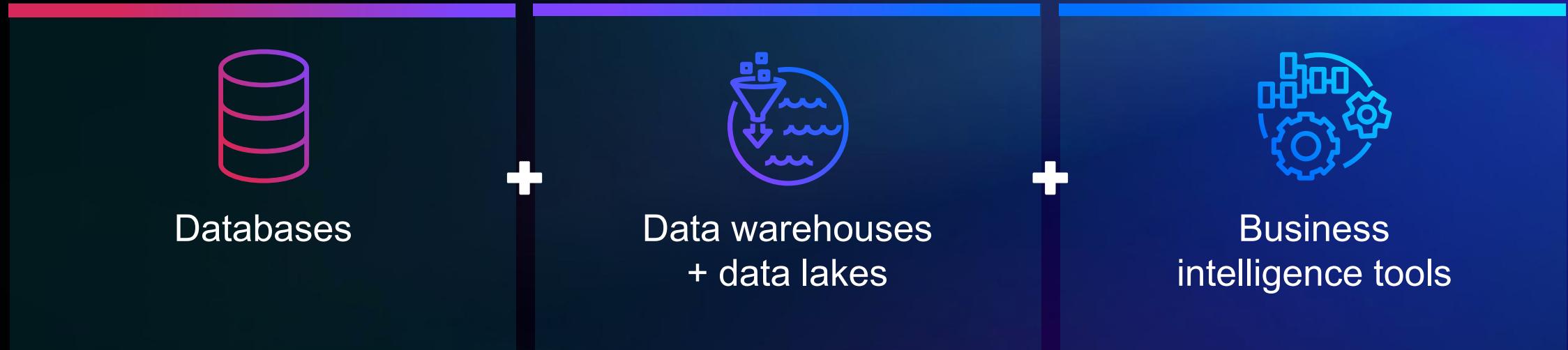
Visually debug and monitor Spark jobs inline in same notebook



Build ML workflows

Build end-to-end ML workflows without leaving the notebook

AWS brings ML closer to data



Amazon Redshift ML

Create, train, and deploy ML models
using familiar SQL commands



No prior ML experience required



Use simple SQL queries for
ML tasks



Fast predictions

Amazon Redshift ML

Create, train, and deploy ML models
using familiar SQL commands

80 billion
predictions per week

Amazon QuickSight ML

Self-service BI for everyone



Machine learning-powered insights



Natural language querying capability

More than 1.5 million AWS customers use database, analytics, or machine learning AWS services



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Amazon QuickSight

Unified BI service at hyperscale



Unified BI for all your analytics needs



Build **data-rich experiences** fast



Consistent high performance
with auto scaling



Lower costs with
consumption-based pricing

Amazon QuickSight



01

**MODERN
DASHBOARDS**



02

**EMBEDDED
ANALYTICS**



03

NLQ

UPDATED



04

REPORTS

NEW



05

SERVERLESS BI

QuickSight paginated reports

NEW

[GA]

Highly formatted,
printable reports

Familiar interface for
authoring & consumption

Serverless, auto scales to
meet demand

Out-of-the-box archival,
up to 1 year

The image shows a tablet displaying the QuickSight interface. On the left, the authoring interface includes a sidebar with 'Repeat section' (selected), 'Style', 'Filter', 'Insights', 'Parameters' (with 'Country' selected), 'Actions', 'Themes', and 'Settings'. A main panel shows a repeating section configuration with placeholder text: 'You can configure a section to repeat for each dimension value.' Below this is a 'GET STARTED' button and a 'Find a field' search bar with 'City' selected. On the right, a paginated report preview titled 'Sales pipeline' is shown. It features a top navigation bar with 'Topics' and a search bar. The report includes a summary text block, a circular donut chart labeled '\$474K' showing sales by product category, and a table titled 'Order details' with columns for Order ID, Order Date, Contact, Country, Customer, Industry, License, Order Date, and Sales.

QuickSight paginated reports

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Highly formatted,
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up to 1 year



ML-powered insights

Forecasting and “**Why**” questions

Automated data prep



NEW

[GA]

Amazon QuickSight automation API



Treat BI assets as code and
create programmatic BI
deployment pipelines

Suite of APIs that accelerates
Business Intelligence (BI)
migration to the cloud

QuickSight cost benefits



Auto scale



Manage
easily



Unify BI
approaches

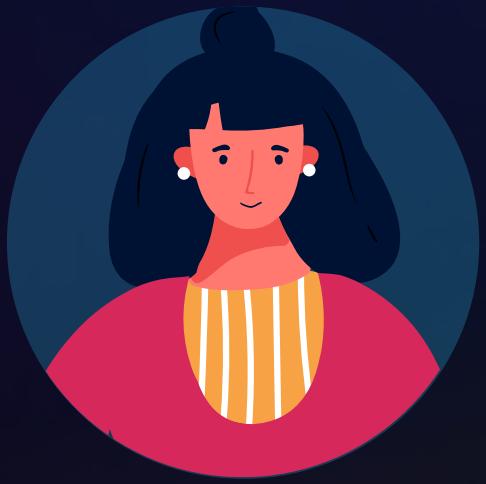


Consumption
pricing

Octank will invest in **STEM learning toys for girls**

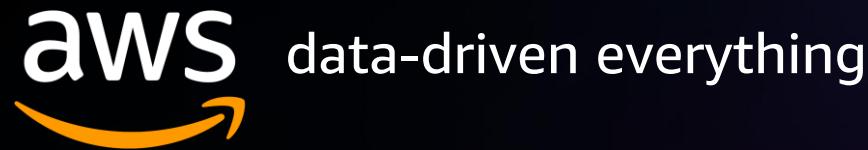
The tablet screen shows a data analysis interface with various filters and charts. One chart displays a compensation trend for December 2016, showing a value of -\$30,43. The filters panel on the right includes a section for 'Gender equals Female' and a 'FILTER' button. Below the dashboard, there is a video frame showing two young girls working on a STEM project, possibly building a robot or a similar mechanical device.

"What product category
should we invest in?"



OCTANK CEO

Want to build a data vision and strategy?



- Joint engagements with business and technology stakeholder alignment
- Create an organizational vision for innovation with data to drive business outcomes
- Define the first pilot, learn, and build

Jumpstart the data flywheel

Have a strategy and need help executing?



- Joint engineering engagements between customers and AWS technical resources
- Create tangible deliverables to accelerate strategic databases, analytics, and ML initiatives
- Leave with an architecture, working prototype, path to production, and deeper knowledge of AWS services

Come with an idea, leave with a solution

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Building Modern Data Analytics Solutions on AWS
(new collection of Classroom Trainings)



Data Analytics Fundamentals



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Popular analytics sessions to check out

| Session ID | Title | Venue & room |
|--|---|---|
| ANT403 ANT316-R | Event detection with Amazon MSK and Amazon Kinesis Data Analytics How to build dashboards for machine-generated data | Mandalay Bay Level 1 North, Islander C MGM Grand Level 3, Premier 320 |
| ANT329 | Turn data to insights in seconds with secure and reliable Amazon Redshift | Wynn Level 1, Montrachet 1 |
| ANT207 | What's new in AWS streaming | MGM Grand Level 1, Terrace 151 |
| ANT336 ANT401 | Building data mesh architectures on AWS Ingest data at scale with Amazon OpenSearch Service | Wynn Upper Level, Cristal 7 Mandalay Bay Level 2 South, Oceanside F |
| ANT330-R1 ANT342 ANT333-R1 | Run Apache Spark on Kubernetes with Amazon EMR on Amazon EKS [REPEAT] How Poshmark accelerates growth via real-time analytics & personalization Build a serverless data streaming workload with Amazon Kinesis [REPEAT] | Caesars Forum Level 1, Forum 110 Mandalay Bay Level 3 South, Jasmine H MGM Grand Level 3, 301 |
| ANT308 | Seamless data sharing using Amazon Redshift | Wynn Upper Level, Cristal 1 |
| ANT219 ANT209 | Dow Jones and 3M: Observability with Amazon OpenSearch Service Build interactive analytics applications | Venetian Level 2, Venetian Theatre Mandalay Bay Level 2 South, Lagoon L |
| ANT311 ANT309-R1 | Building security operations with Amazon OpenSearch Service Build analytics applications using Apache Spark with Amazon EMR Serverless [REPEAT] | Caesars Forum Level 1, Summit 214 Venetian Level 3, Murano 3204 |
| ANT314-R1 | Why and how to migrate to Amazon OpenSearch Service [REPEAT] | Caesars Forum Level 1, Forum 101 |
| ANT322-R1 | Simplifying ETL migration and data integration with AWS Glue [REPEAT] | Caesars Forum Level 1, Summit 217 |



Thank you!



Please complete the session
survey in the **mobile app**