
AWS
re:Invent
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FSI203

NatWest: Personalizing banking at scale with machine learning on AWS

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Our journey

WE CHAMPION POTENTIAL – HELPING PEOPLE, FAMILIES, AND BUSINESSES TO THRIVE

We are a leading UK bank

With a large and unique data asset

Supporting multiple franchises

Leveraging analytics at scale

~19 million
customers

~60k
staff worldwide

750 million
financial transactions per month

NatWest Group

~500
data scientists and data engineers

1 in 4
UK payments processed in 2021

NatWest | Royal Bank of Scotland | Coutts | NatWest Markets

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Our data strategy

SUPPORTING CUSTOMERS AT EVERY STAGE OF THEIR LIVES, BUILDING CLOSER AND DEEPER RELATIONSHIPS

How we are helping our customers by driving a personalized, sustainable, and embedded response



Scale and optimize a data-driven bank



Leverage our data advantage for good



Champion customer centricity

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Delivering personalization

PERSONALIZED CUSTOMER ENGAGEMENT USING MACHINE LEARNING ACROSS THE ENTERPRISE



Faster to start



Quicker to live



Sharing data

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Faster to start



Quicker to live



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Real ML solutions

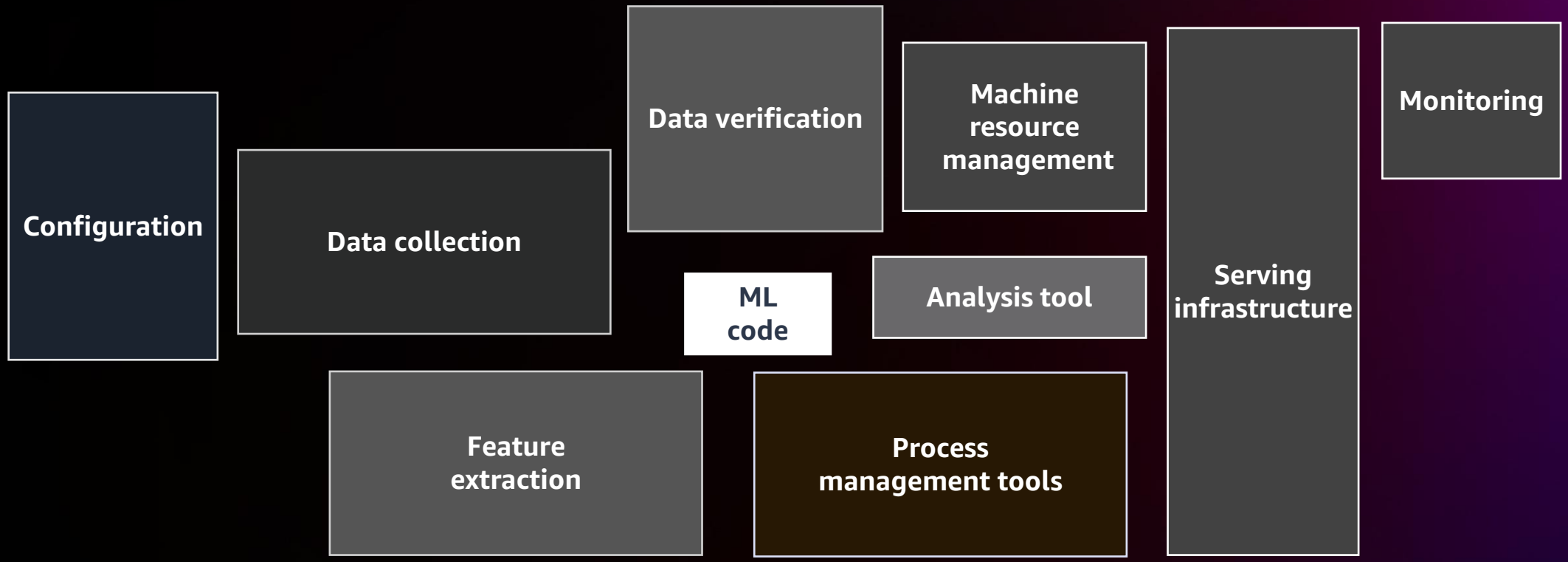
MACHINE LEARNING CODE AND DATA SCIENCE NOTEBOOKS . . .



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Real ML solutions

. . . IS ONE SMALL PART OF THE OVERALL DEPLOYMENT PICTURE



“Only a small fraction of real-world ML systems are composed of ML code.”

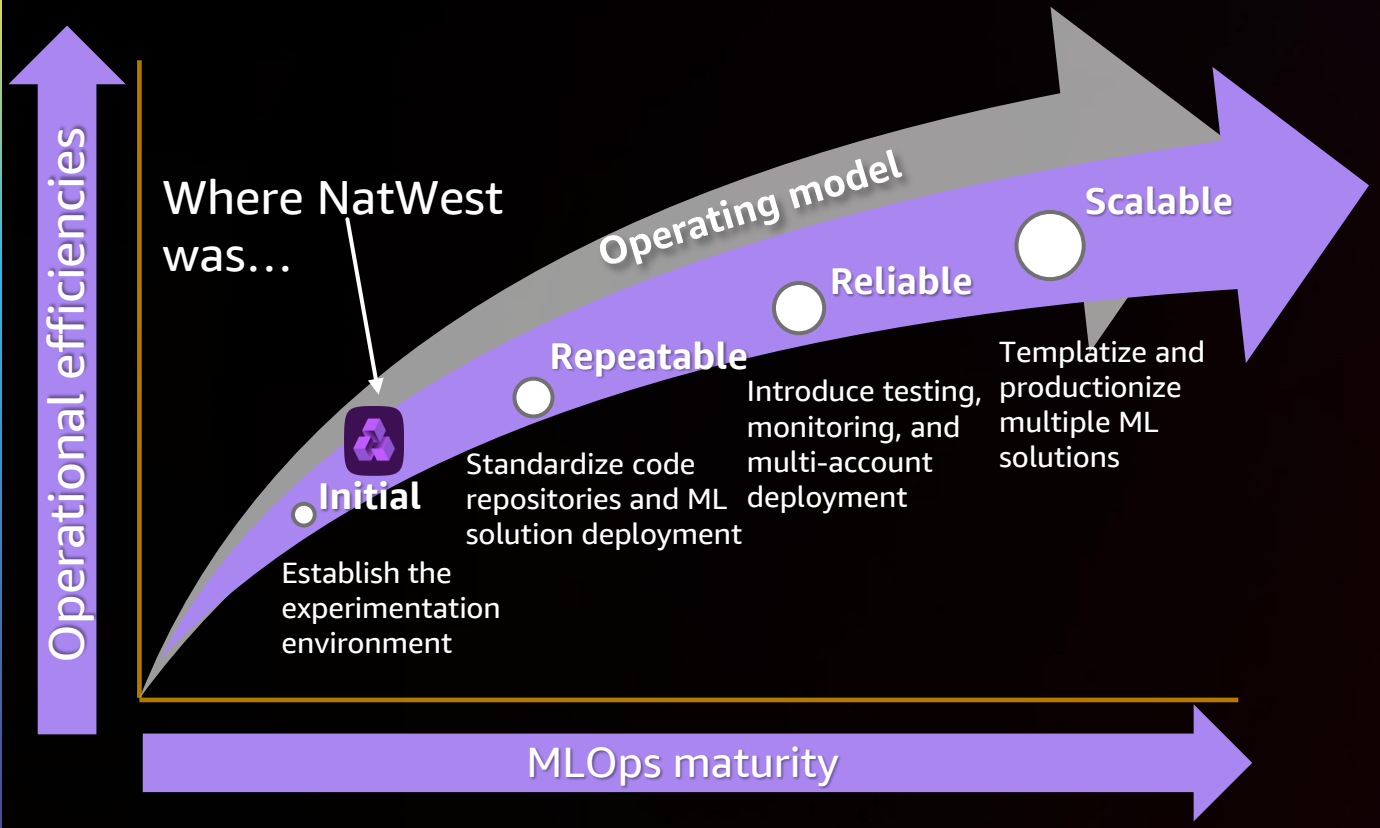
Hidden technical debt in machine learning systems, Sculley et al., 2015

https://papers.nips.cc/paper/5656-hidden-technical-debt-in-machine-learning-systems.pdf

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Measuring our success



Outcomes

Faster delivery of end-to-end solutions	12 months
Simplified discovery and access to data	~ 5 days
Simplified ML-model route-to-live	3-6 months
End-user self-service environment creation	> 40 days

Where NatWest was

* Other metrics also used during project delivery

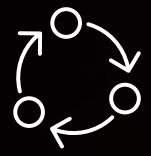
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Our vision for machine learning operations

HOW WE HAVE TACKLED OUR BARRIERS TO ML ADOPTION



Automation and standardized patterns



Optimized governance



Simplified data access



Modern tech stack

Faster time-to-value



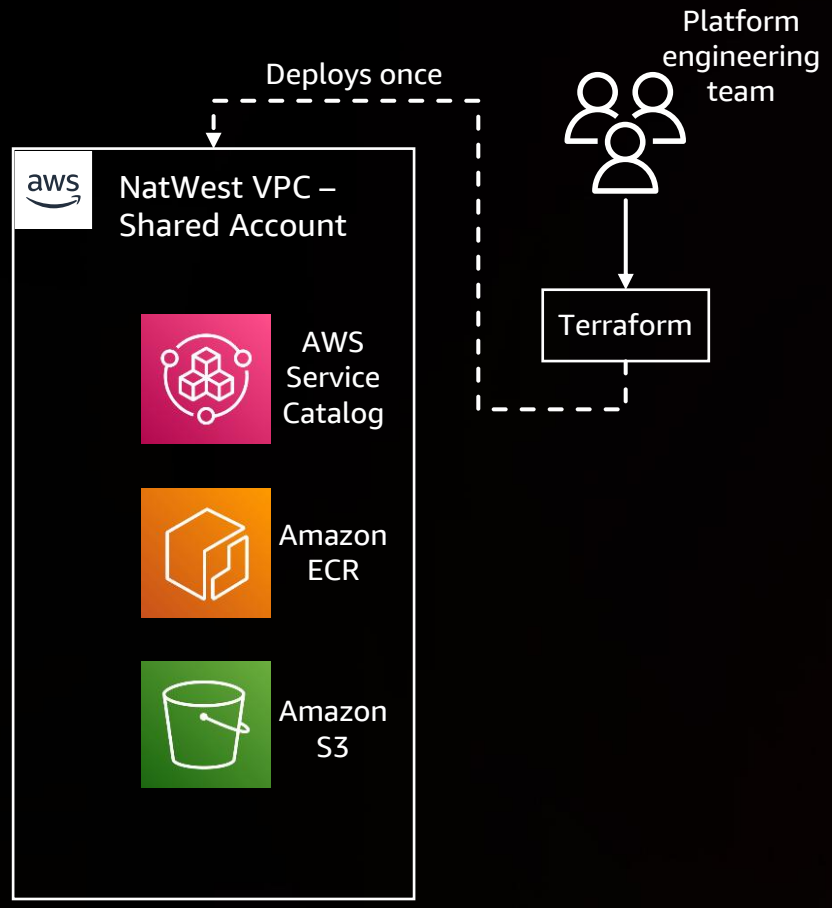
For more details about NatWest's ML journey see **AIM321: Productionize ML workloads using Amazon SageMaker MLOps, feat. NatWest**

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Our MLOps architecture

PROVIDING SELF-SERVICE TOOLS AND PROCESSES FOR REPEATABLE MODEL DEVELOPMENT AND DEPLOYMENT



Constraints

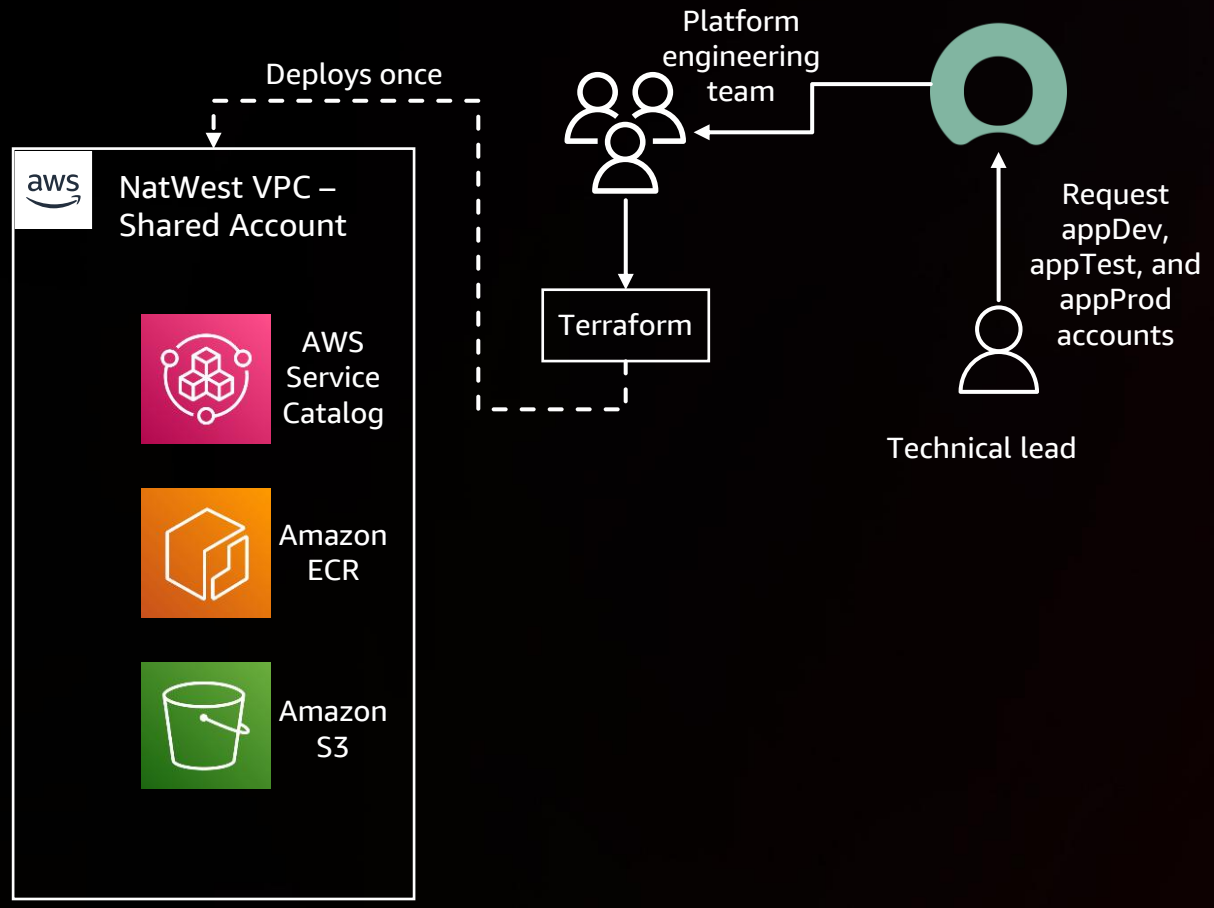
No public-internet access has forced several design choices

[Part 1: How NatWest Group built a scalable, secure, and sustainable MLOps platform | AWS Machine Learning Blog (amazon.com)]

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Our MLOps architecture

PROVIDING SELF-SERVICE TOOLS AND PROCESSES FOR REPEATABLE MODEL DEVELOPMENT AND DEPLOYMENT



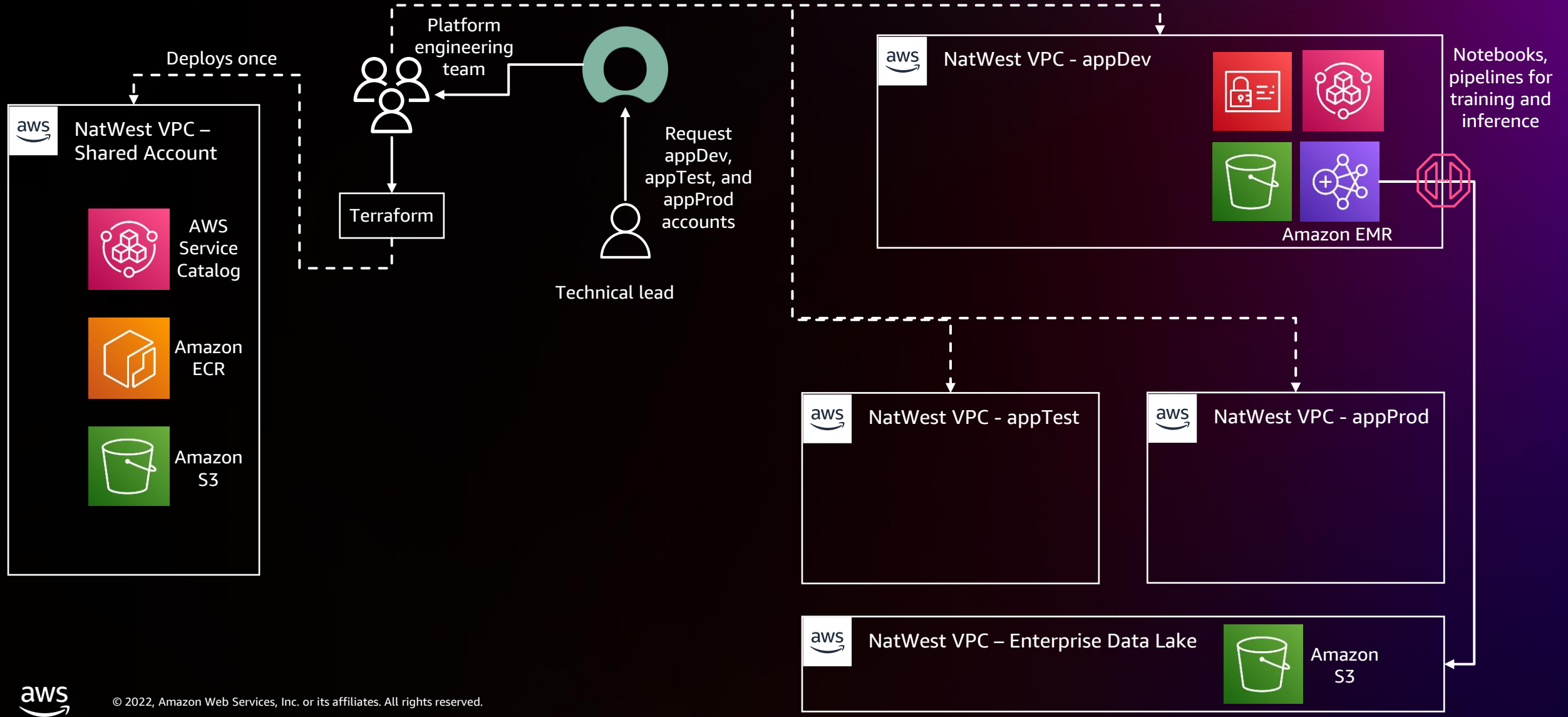
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NatWest VPC – Enterprise Data Lake

Amazon S3

Our MLOps architecture

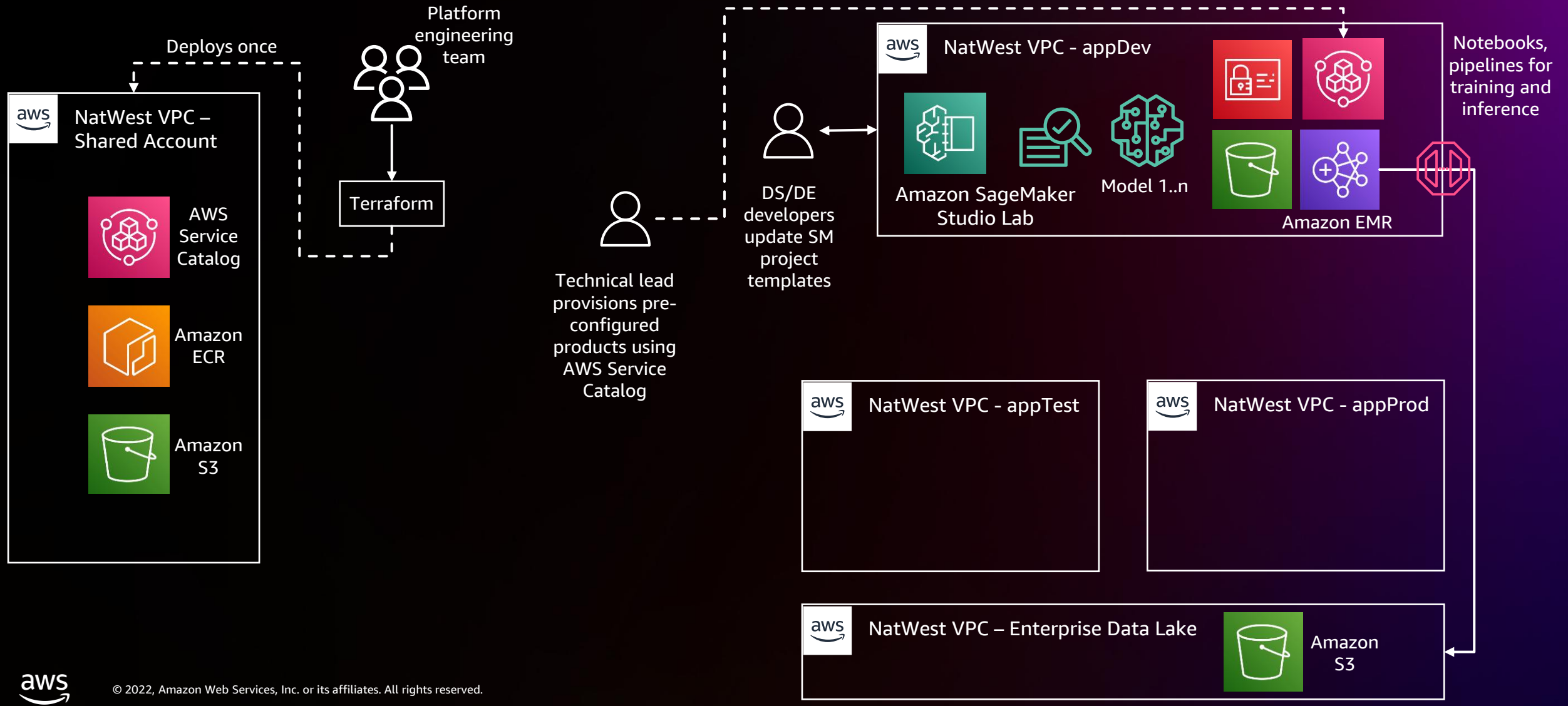
PROVIDING SELF-SERVICE TOOLS AND PROCESSES FOR REPEATABLE MODEL DEVELOPMENT AND DEPLOYMENT



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Our MLOps architecture

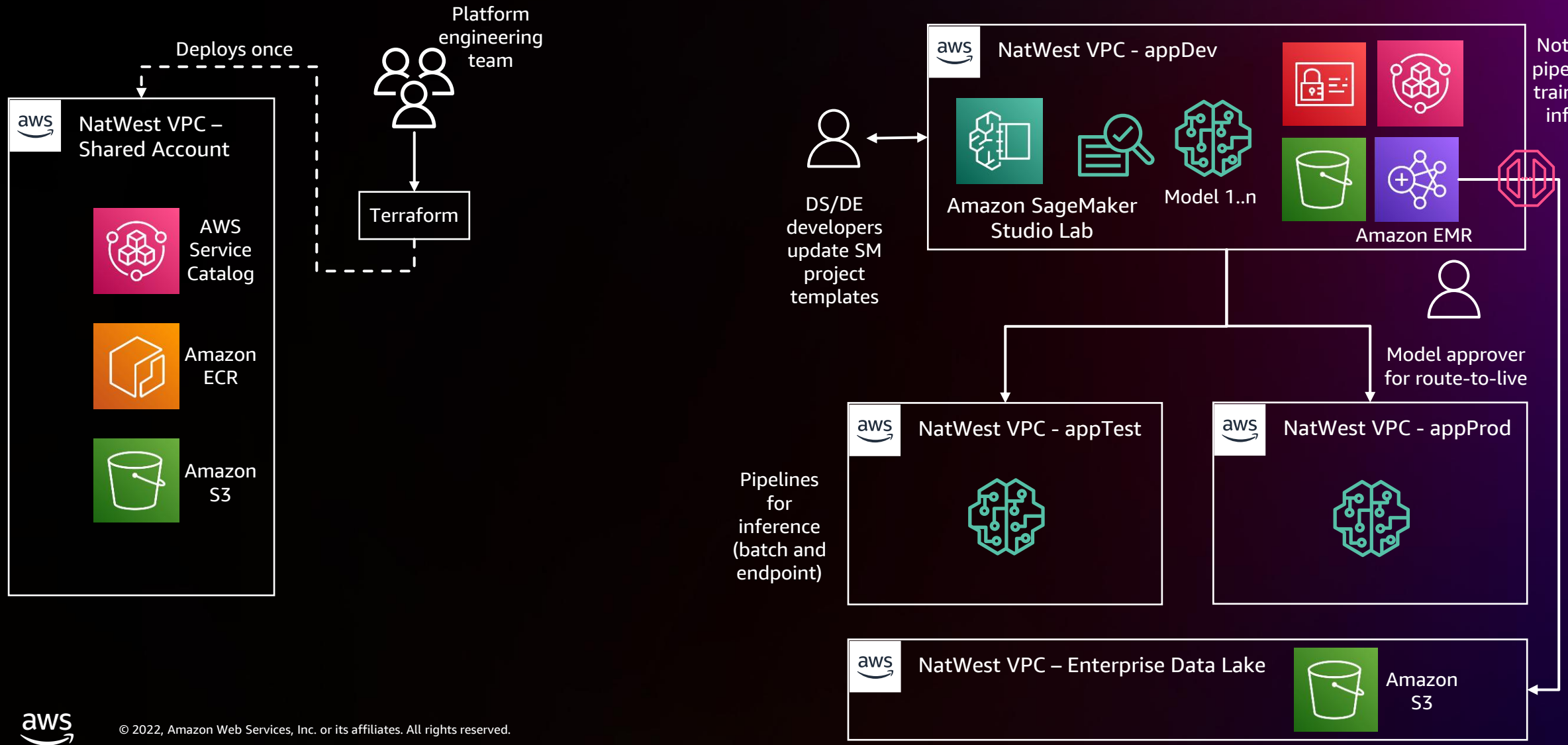
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Our MLOps architecture

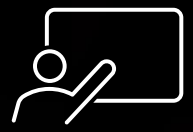
PROVIDING SELF-SERVICE TOOLS AND PROCESSES FOR REPEATABLE MODEL DEVELOPMENT AND DEPLOYMENT



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Adoption and engagement

BUILDING A LONG-TERM CAPABILITY ACROSS THE ENTERPRISE



Training

Trained **100s** of data scientists, engineers, and leaders



Dedicated support

Established **enablement** team driving adoption and engagement



Visible metrics

Constantly **track and report** training, usage, and performance KPIs



User champions

Validate and promote capabilities using **early adopters**



Reach far and wide

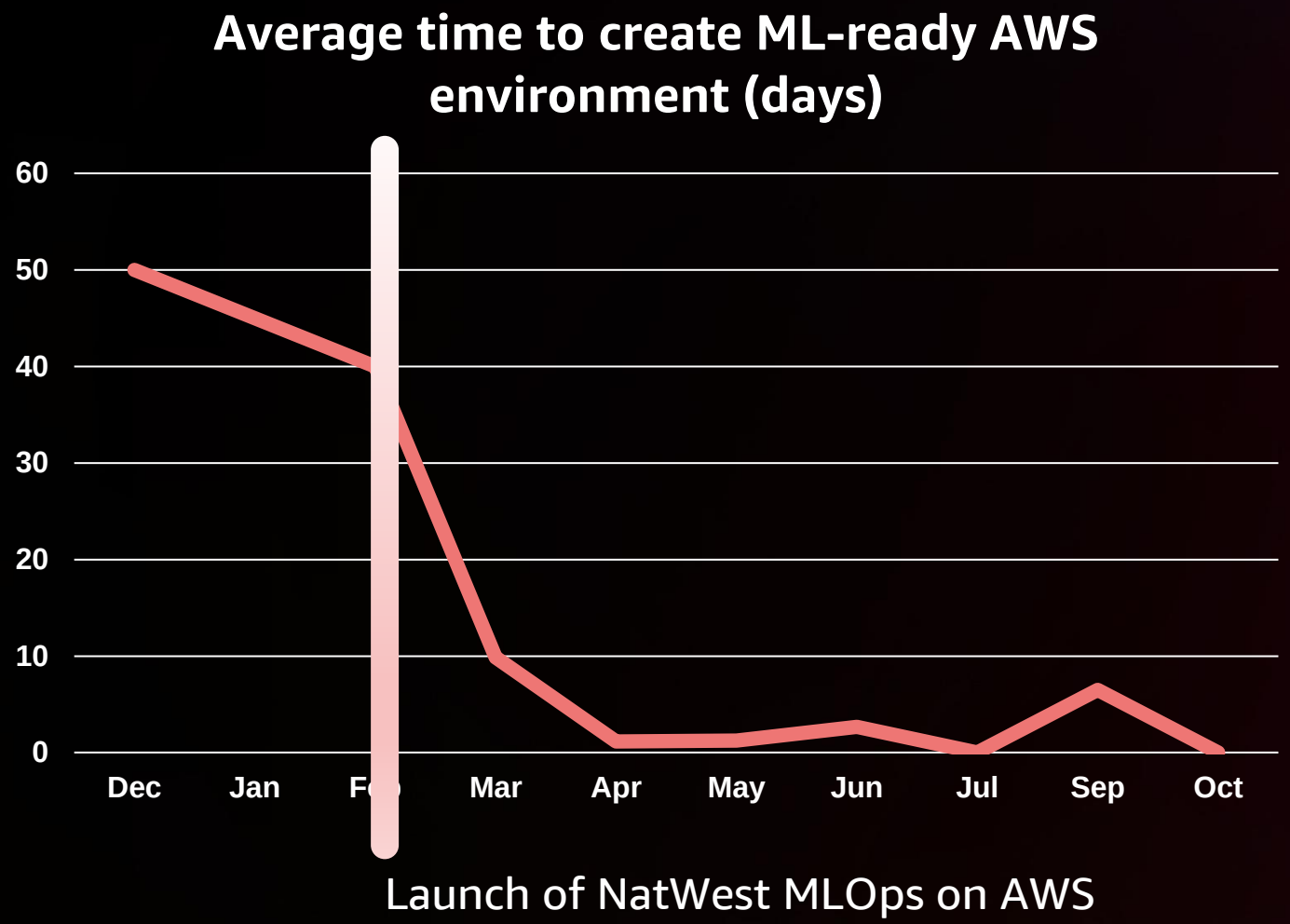
Onboard project teams/use cases **across the organization**

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Self-service creation of our ML environments

REDUCING TIME TO VALUE CONSISTENTLY AND AT SCALE



< 2 hours

From empty account to having an Amazon SageMaker Studio domain ready for development

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Faster to start



Quicker to live

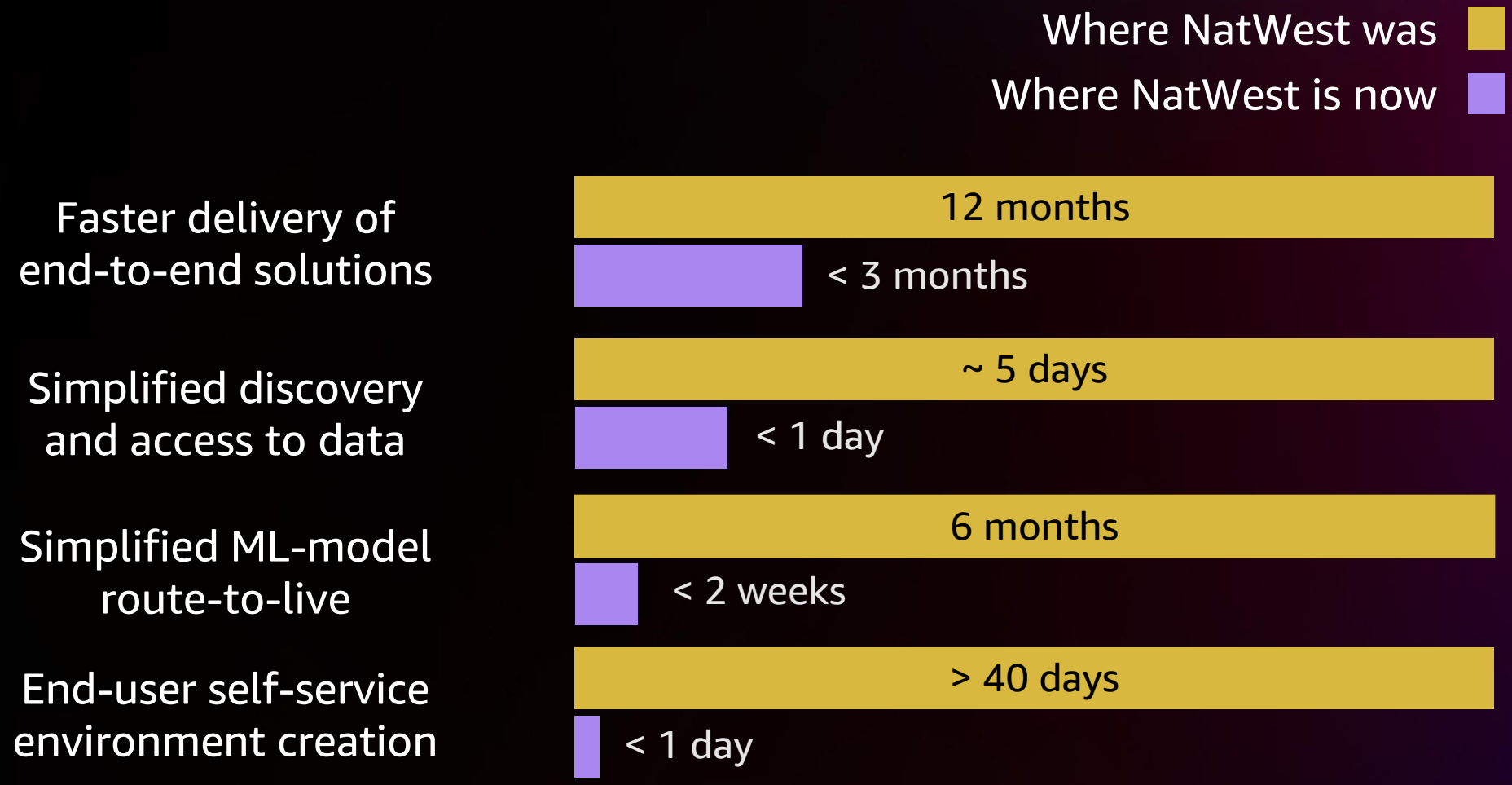


Sharing data

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Measuring our success

A METRIC-BASED APPROACH FOCUSED ON VALUE



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Increasing our pace creating customer insights

HOW CLOUD AND ML IS ENABLING SPEED AND SCALE IN UNDERSTANDING OUR CUSTOMERS NEEDS



Quicker to live





Champion customer centricity

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Understanding our customers' conversations

Goals:

Support our customers more effectively at an individual level and drive operational efficiency

1. Optimize customer journey personalization
2. Support customer self-service
3. Increase customer satisfaction
4. Improve operational efficiency

What we delivered:

Automated insights for analyzing customer conversations from webchat and call-center channels



Understanding individual conversations

- Reason of call
- Resolution of call



Creating deeper insights to driving personalized action

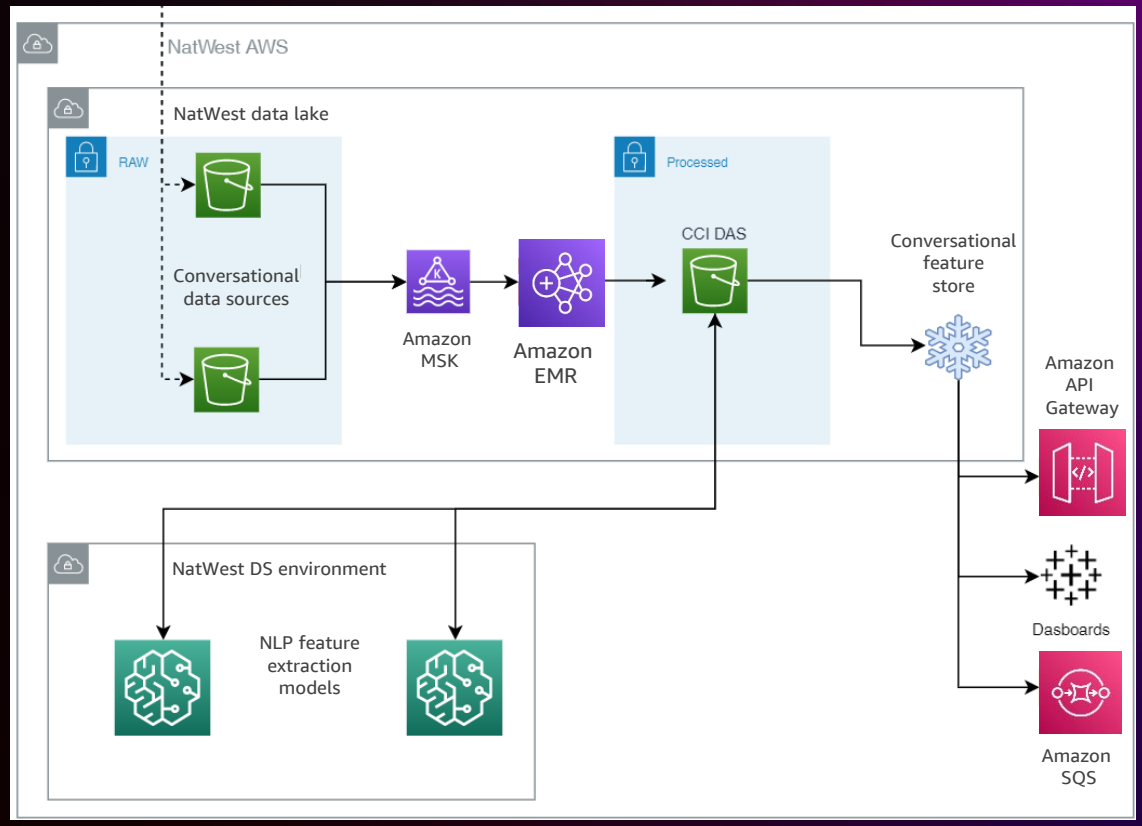
- Customer experience
- Customer engagement

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Understanding our customers' conversations

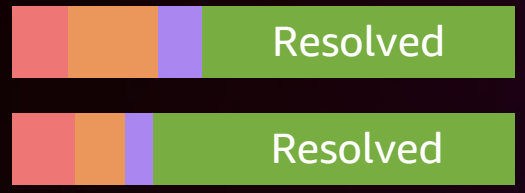
Business outcome	Reason of conversation	Resolution status of conversation
Data-volume per day	~40k webchat conversations	~75k voice calls
ML model type	BERTtopic	Fasttext classifier + active learning
From idea to live	6 months . . . but we broke through many barriers leading to massive acceleration of next use cases	
What made this possible	Access to the latest ML algorithms Scalable compute on demand	



Example

['Card', 'Order']

['Account', 'Open']



Deferred
Dropped
Not resolved
Resolved

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Faster to start



Quicker to live

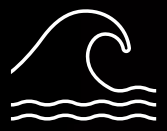


Sharing data

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Our data lake journey

CREATING INTERNAL DATA-SHARING CAPABILITIES



Scaling up our data lake

400TB data and **> 35k** tables

Centralized platform team including specialist capabilities and skills



Going faster with re-use

Custom Amazon SageMaker Feature Store saving ~30% data engineering effort for ML projects that drive business value



Driving enterprise-wide usage

Supporting > 30+ applications across ML development, regulatory reporting, and customer facing

Single metadata catalog for access to data for cross-domain teams

Challenges

Complex user and application access controls across domains

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Deep customer insights driving personalization

UNDERSTANDING OUR CUSTOMERS ENABLES THE CREATION OF RELEVANT AND MEANINGFUL EXPERIENCES



Sharing data





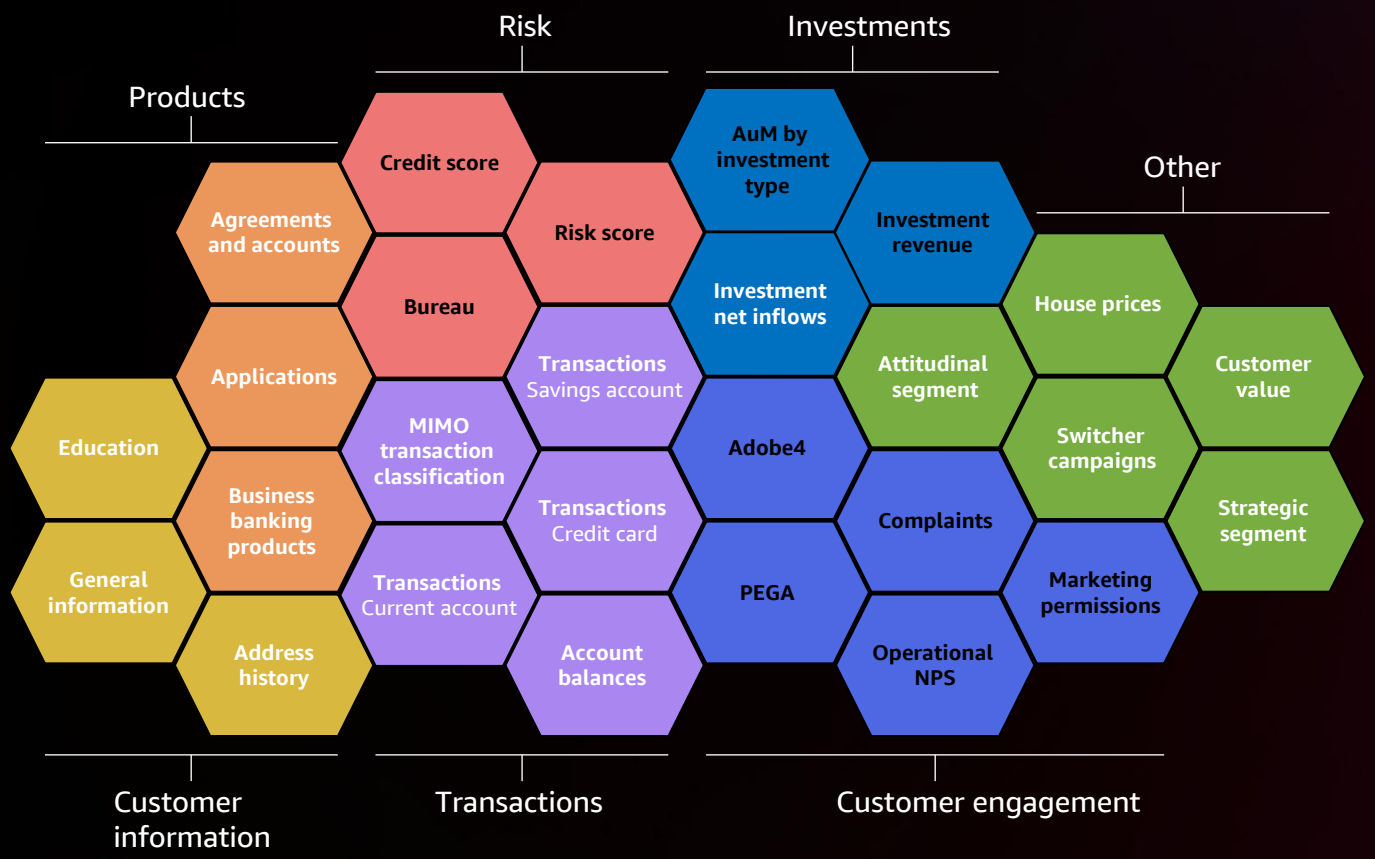
Champion customer centricity

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Our CLV data asset

ENABLING PERSONALIZED ENGAGEMENT



The CLV data asset **contains 30+ data sources**, capturing information on **customer product holdings, transactions, behaviors and risks, demographics, risk, and engagement.**

The data asset **leverages 400bn+ rows** of raw data and synthesizes **~900 pieces of information** for each **customer** into a central table with **900m+ rows**

CLV enables us to **predict and identify** our customers' future needs so we can focus on helping them achieve their goals

e.g., Customers using our mortgage calculator are 5x more likely to take a mortgage with us than baseline

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Personalizing customer contact

USING CLV



Predict

Evaluate 1-year CLV for every customer



Focus

Look at customers with 1-year propensity towards a need (e.g., purchase product, financial health check . . .)



Rank

List customers from high to low propensity



Target

Select top-X percentile



Uplift

~3x on applications
~5x on drawdowns
~2x on lending

Time-to-value with AWS

Model training **10x** faster
Model inference **4-5x** faster

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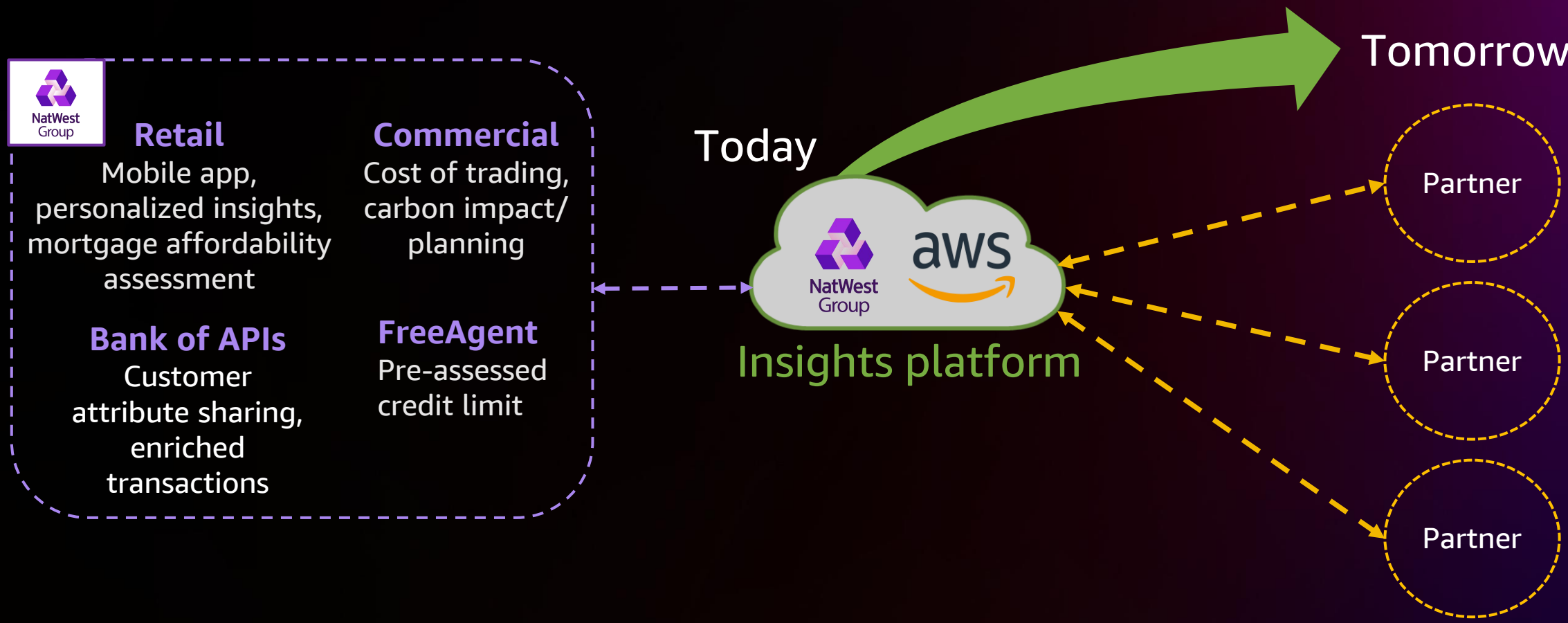
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Sharing data: Where next?

Enabling teams to share and re-use data assets across our organization

Leveraging our cloud and ML data capabilities

Creating scalable insights across a wider partner network



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Sharing data: Where next?

Enabling teams to share and re-use data assets across our organization

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Retail
Mobile app, personalized insights, mortgage affordability assessment

Commercial
Cost of trading, carbon impact/ planning

Bank of APIs
Customer attribute sharing, enriched transactions

FreeAgent
Pre-assessed credit limit

Leveraging our cloud and ML data capabilities

Transaction categorization

- Attribute sharing
  - Name
  - Date of birth
  - Address
- Income and expenditure
  - Extract
  - Allocate
  - Validate
- Insights
  - Alert and plan
  - Predict
  - Impact

NatWest Group aws

Insights platform

Creating scalable insights across a wider partner network

Outcomes

- Open banking and third-party pay/account providers
  - ✓ Reduce overheads
  - ✓ Validate authenticity
  - ✓ Right first time
- Banks
  Building society
  Brokers
  Aggregators
  - ✓ Reduce cost
  - ✓ Increase approval rates
  - ✓ Credit risk/treasury planning
- Consumers
  Businesses
  Subscription managers
  - ✓ Supporting life goals
  - ✓ Early event triggers
  - ✓ Making savings

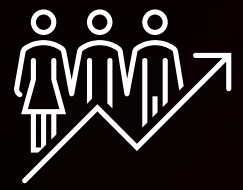
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Delivering personalization

PERSONALIZED CUSTOMER ENGAGEMENT USING MACHINE LEARNING ACROSS THE ENTERPRISE

Faster to start + **Quicker to live** + **Sharing data**

= 

Personalization at scale

Helping our customers to thrive

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Thank you!

Zachery Anderson
Zachery Anderson

Dr. Greig Cowan
Greig Cowan

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