

The background of the image is a dark blue gradient on the left, transitioning into a large, abstract, curved shape on the right. This shape is composed of various shades of purple and blue, with a bright orange-yellow curved line running along its bottom edge. The overall design is modern and dynamic.

# aws SUMMIT

LONDON | APRIL 27, 2022

ML-07

# Implement MLOps practices with Amazon SageMaker

Dr Sokratis Kartakis (he/him)

Snr AI/ML Specialist Solutions Architect  
Amazon Web Services

Dr Greig Cowan (he/him)

Head of Data Science  
NatWest Group



# Agenda

What is MLOps

AWS MLOps Services

Amazon SageMaker Studio, Processing, Pipelines, Model Registry & Project, Lineage Tracking

MLOps Foundation Roadmap

Demo: Data Scientist & MLOps on AWS

MLOps Journey for NatWest



# ML and Path to Production

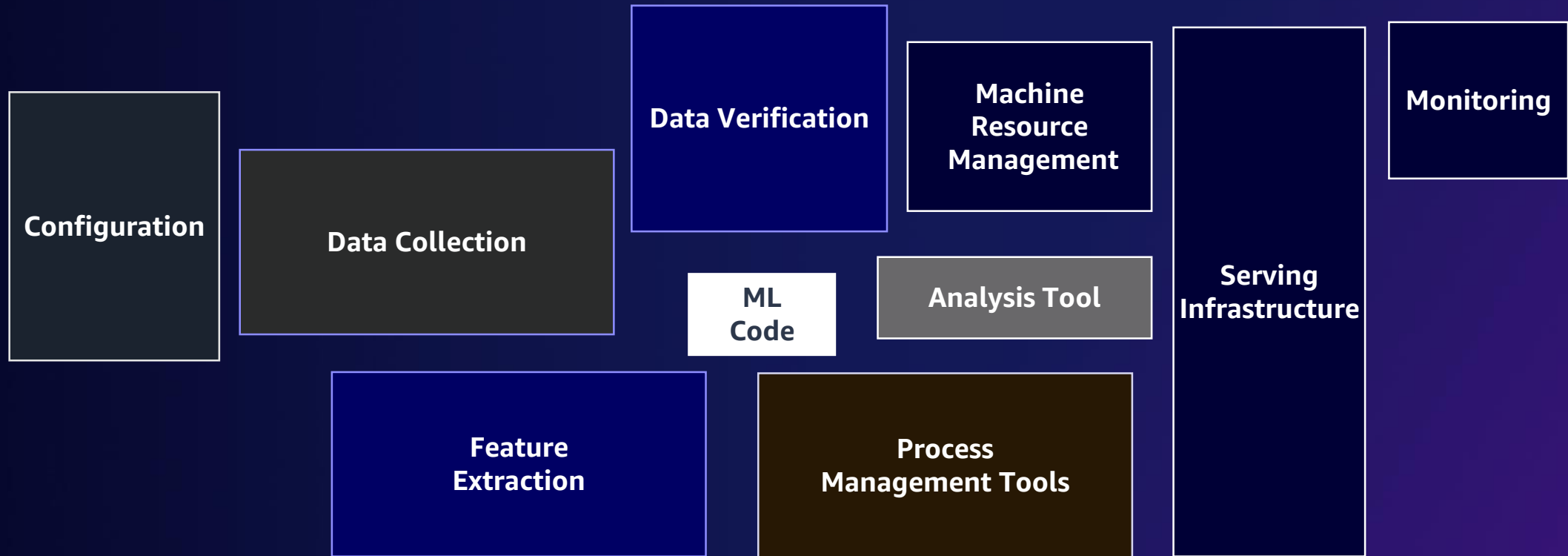
MACHINE LEARNING CODE AND DATA SCIENCE NOTEBOOKS...

ML  
Code



# ML and Path to Production

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



***“Only a small fraction of real-world ML systems is composed of the ML code”***

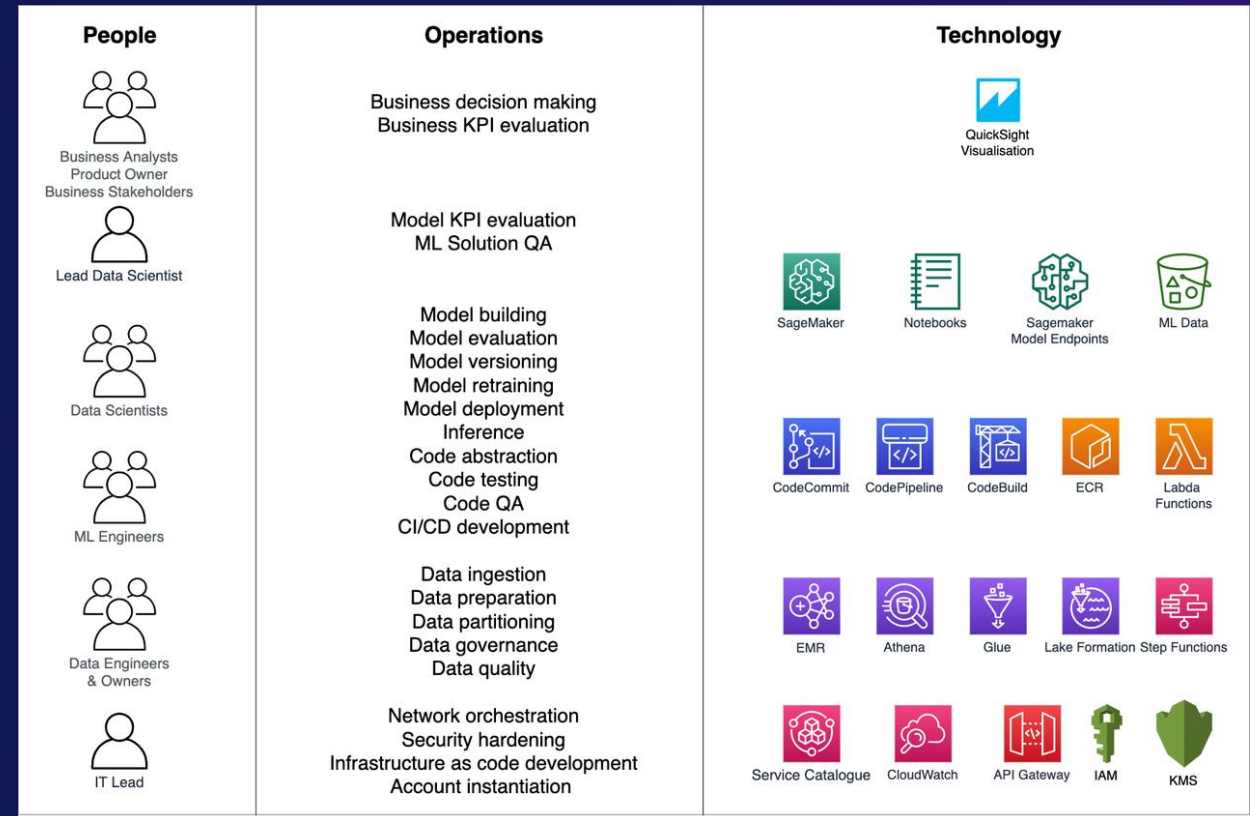
source: Hidden Technical Debt in Machine Learning Systems [D. Sculley, & al.] – 2015

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

# Customer Challenges, ML Lifecycle and Personas

CONSIDERATIONS & CHALLENGES LEAD TO ML AND OPERATIONS (MLOPS)

- Culture
- Lack of cross-functional teams
- Priorities & needs (personas)
- Organizational structure
- Skillsets
- Unique aspects of ML lifecycle

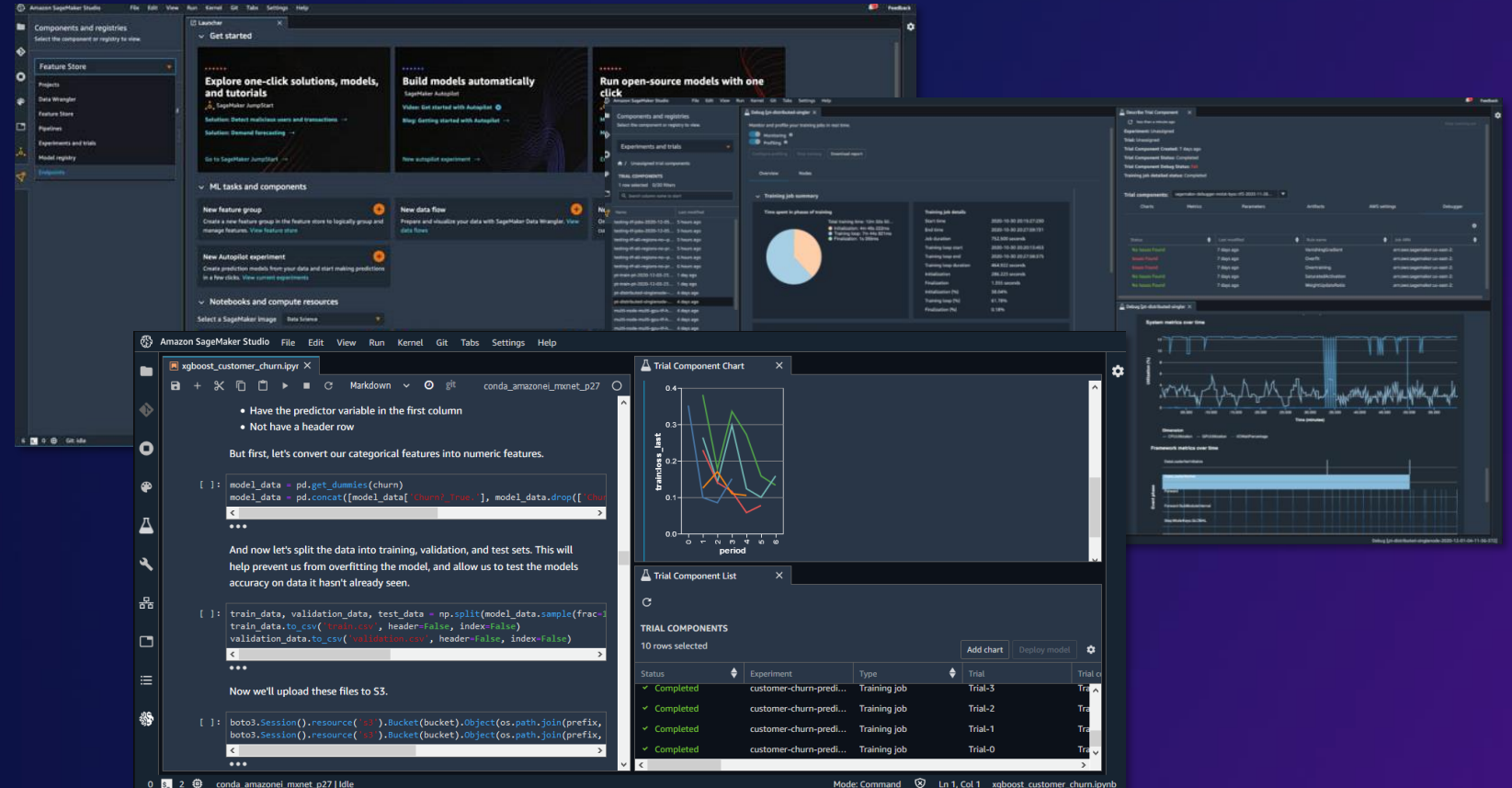
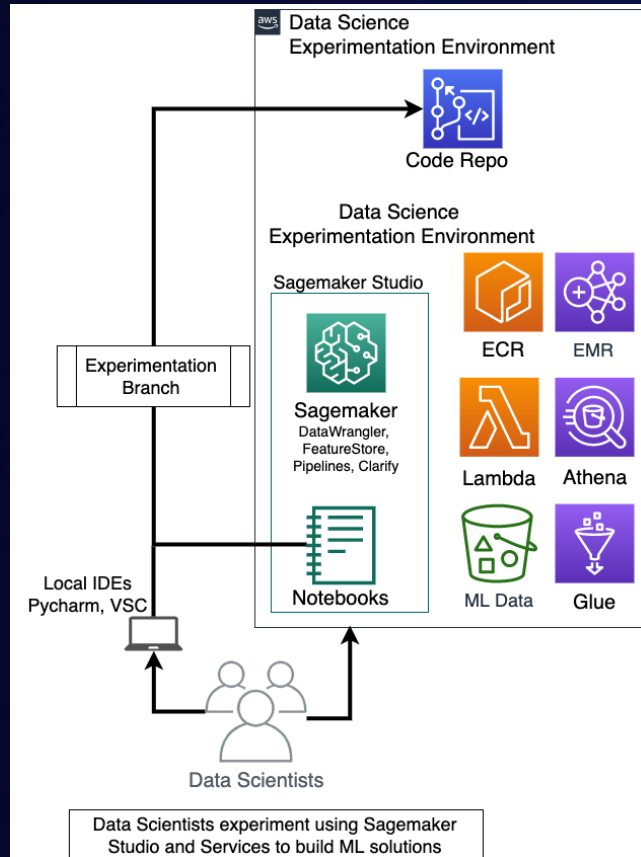


# Amazon SageMaker MLOps Services



# Amazon SageMaker Studio

ML EXPERIMENTATION ON AWS USING AMAZON SAGEMAKER STUDIO NOTEBOOKS

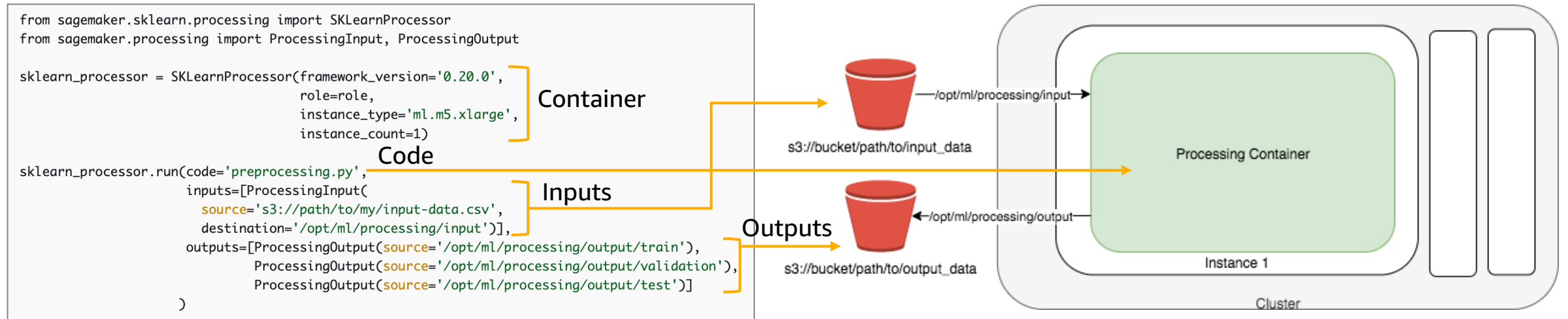






# Amazon SageMaker Processing

PREPROCESS DATA & OFFLOAD DATA SCIENTISTS ON MANAGING CONTAINERS



Supported pre-built processors:



XGBoost

+



Custom Containers

Framework Processors

# Amazon SageMaker Pipelines

AUTOMATED WORKFLOWS TO PRE-PROCESS, TRAIN, EVALUATION, & REGISTER MODELS

Sagemaker Pipelines Training ML Pipeline

```
from sagemaker.sklearn.processing import SKLearnProcessor

sklearn_processor = SKLearnProcessor(framework_version='0.20.0',
                                     role=<role>,

from sagemaker.workflow.pipeline import Pipeline

pipeline_name = f"AbalonePipeline"
pipeline = Pipeline(
    name=pipeline_name,
    parameters=[
        processing_instance_type,
        processing_instance_count,
        training_instance_type,
        model_approval_status,
        input_data,
        batch_data,
    ],
    steps=[step_process, step_train, step_eval, step_cond],
)
    ProcessingOutput(output_name="test", source="/opt/ml/processing/test")
],
code="abalone/preprocessing.py"
)
```

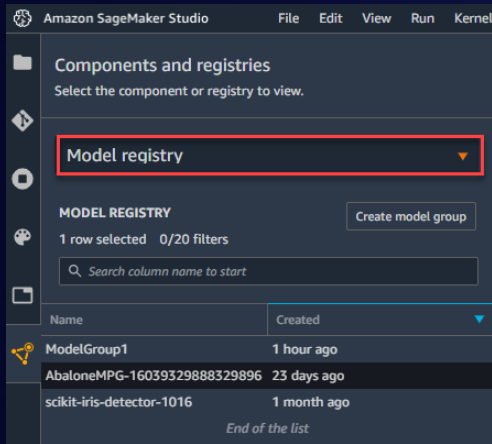
Model Registration

AbaloneTransform

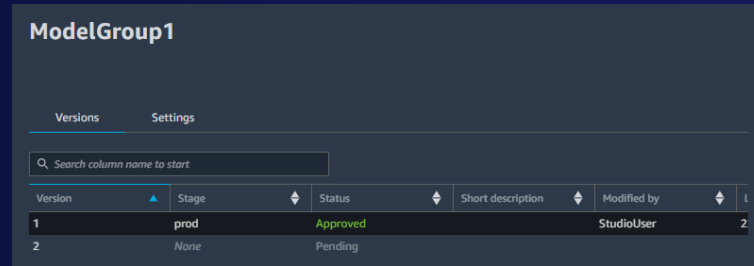
## Step Types

- Processing
- Training
- Tuning
- CreateModel
- RegisterModel
- Transform
- Condition
- Callback
- Lambda Function
- ClarifyCheck
- QualityCheck
- Amazon EMR
- Fail

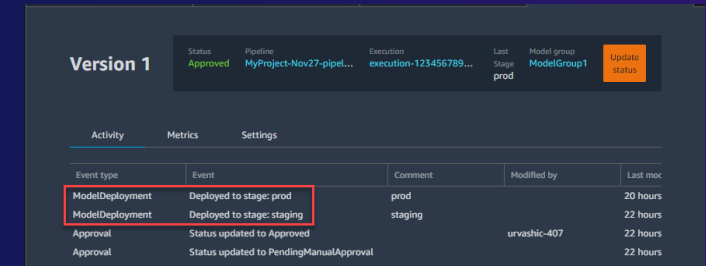
# Amazon SageMaker Model Registry



Create model groups in your model registry



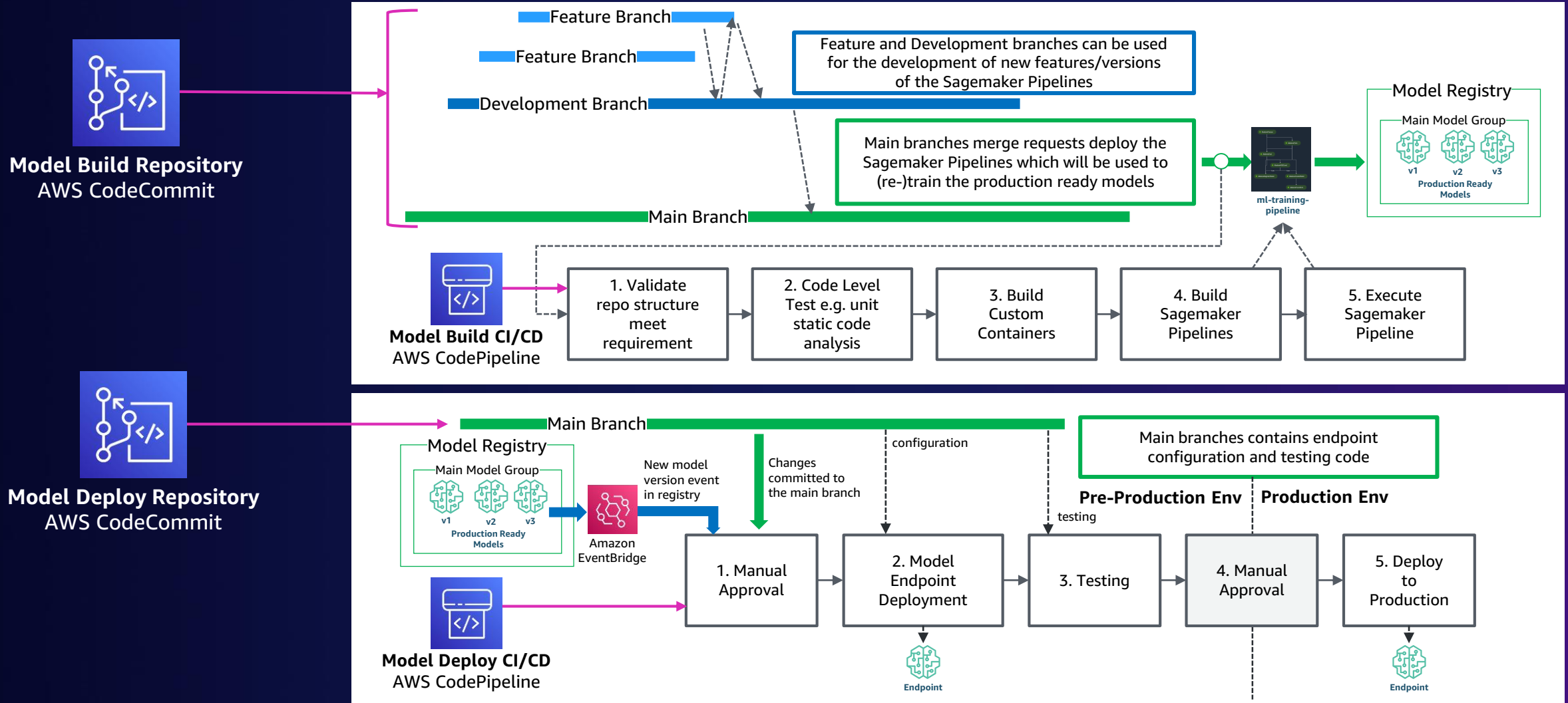
Benchmark and observe the model versions in your model group and promote versions of the model by changing their status



Track the activities, metrics, and settings per model version

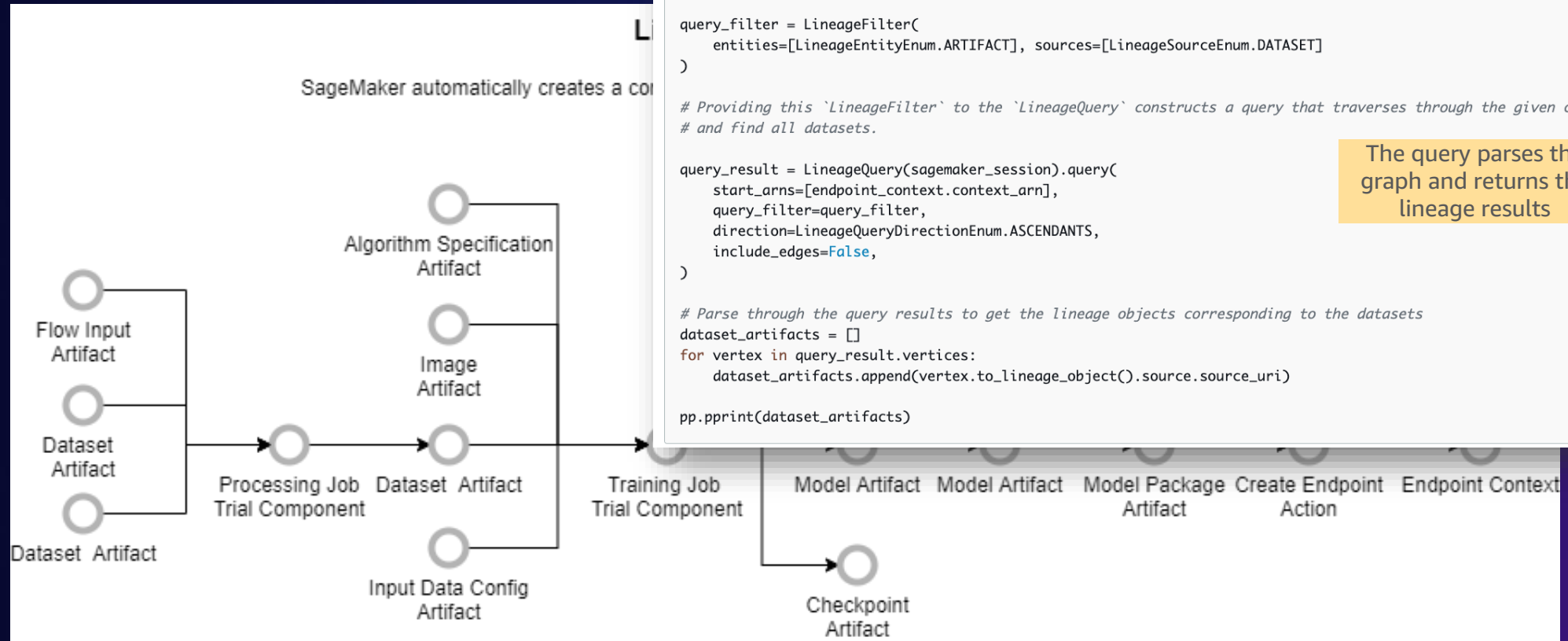
# Amazon SageMaker Projects

## EXAMPLE REPOSITORIES & CI/CD PIPELINES PER SAGEMAKER PROJECT



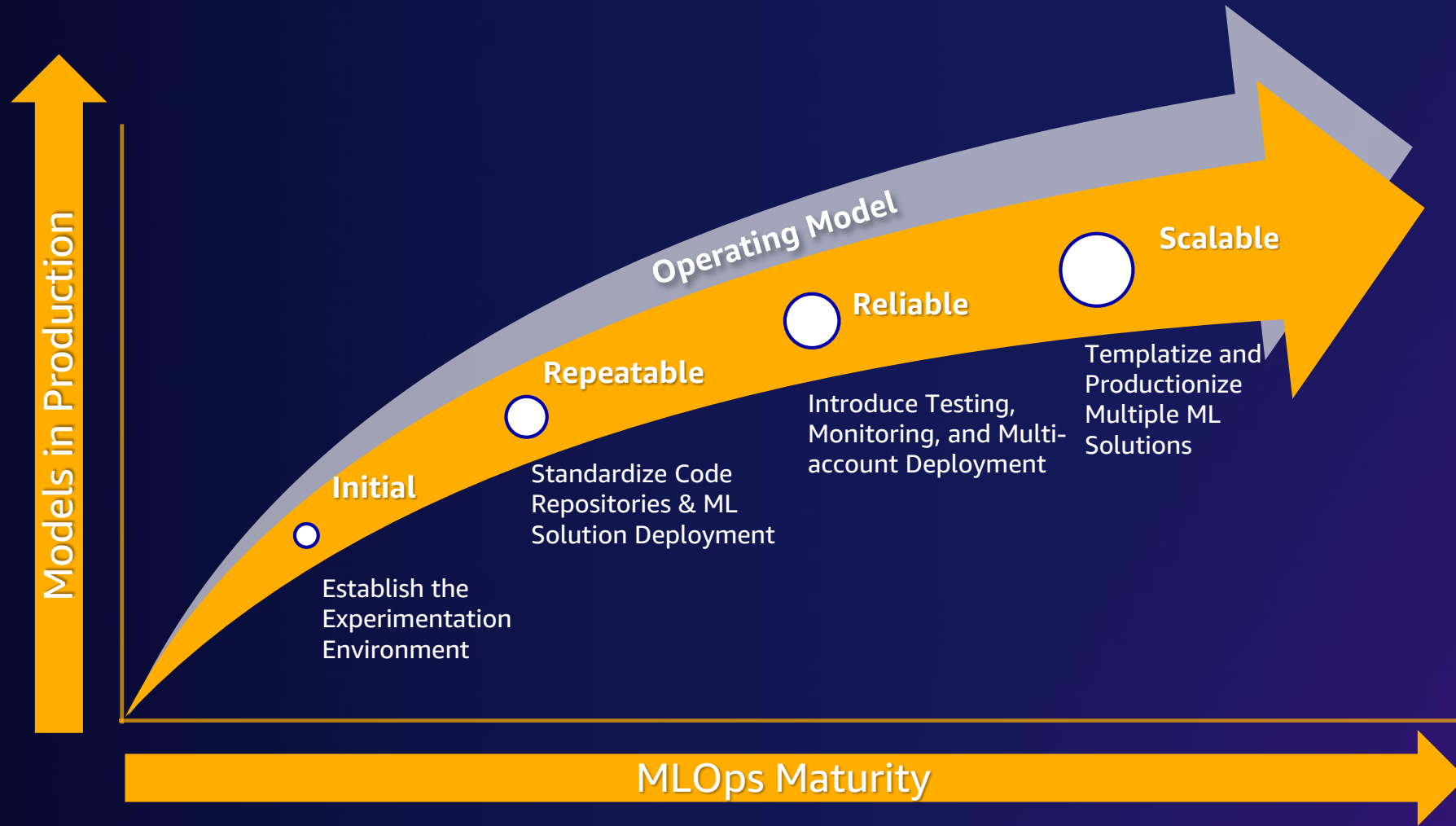
# Amazon SageMaker Lineage Tracking

TRACK WORKFLOW STEPS, MODEL AND DATASET LINEAGE, AND ESTABLISH MODEL GOVERNANCE AND AUDIT



# MLOps Foundation Roadmap

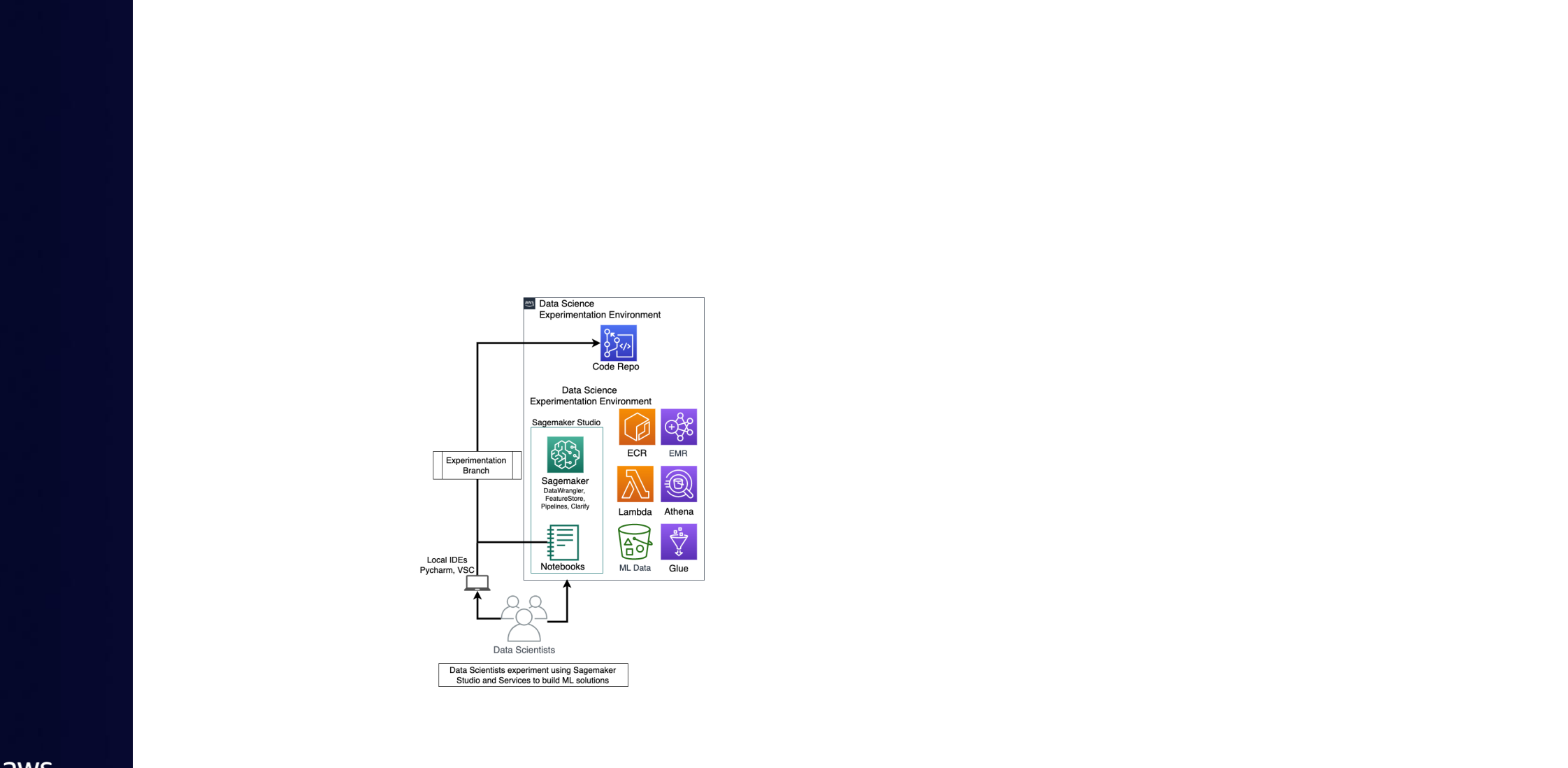
# MLOps Maturity Model





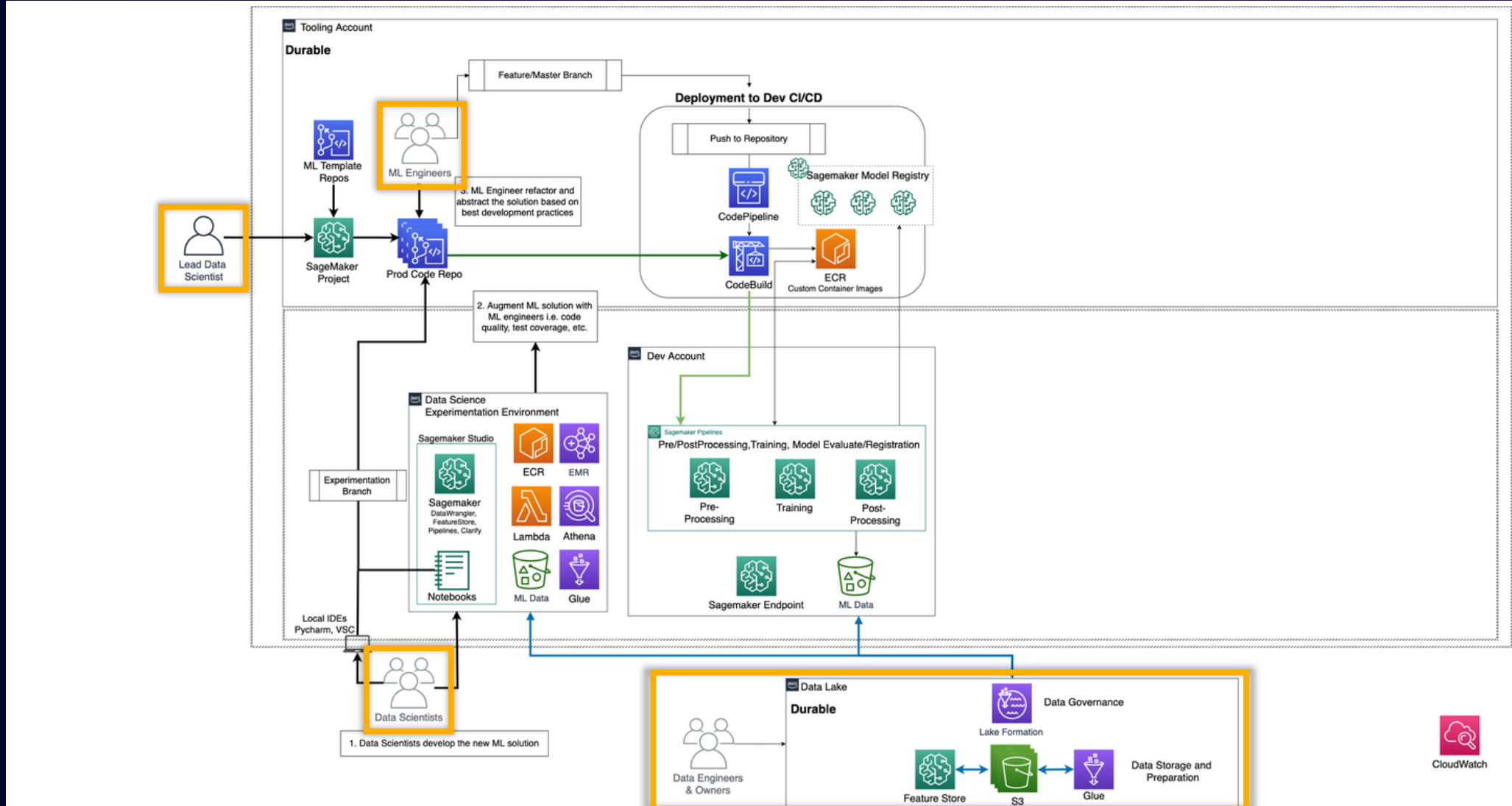
# MLOPs Initial Phase

ML EXPERIMENTATION ON AWS USING AMAZON SAGEMAKER STUDIO NOTEBOOKS



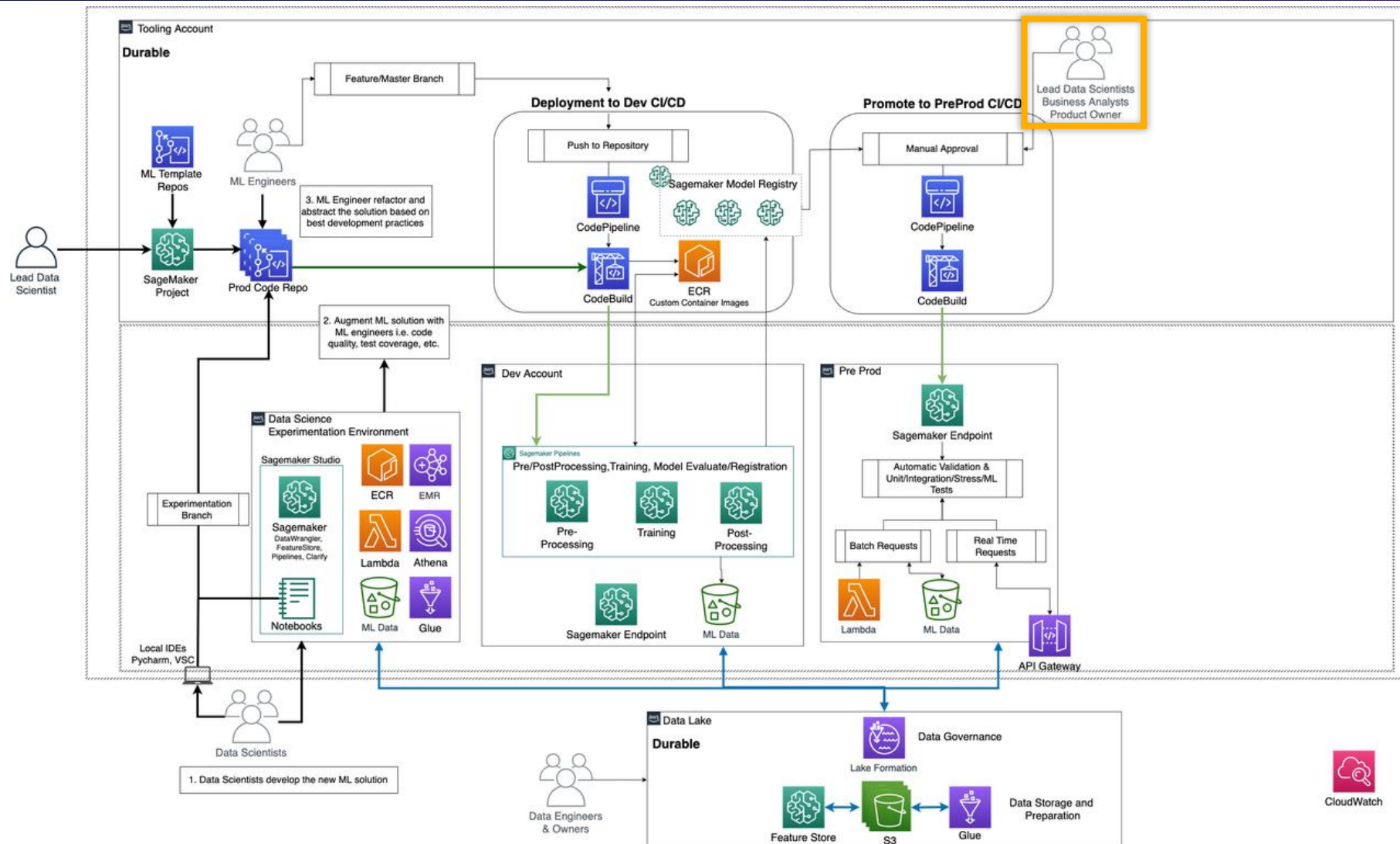
# MLOPs Repeatabile Phase

FROM RESEARCH NOTEBOOKS TO ML PIPELINES & AUTOMATION



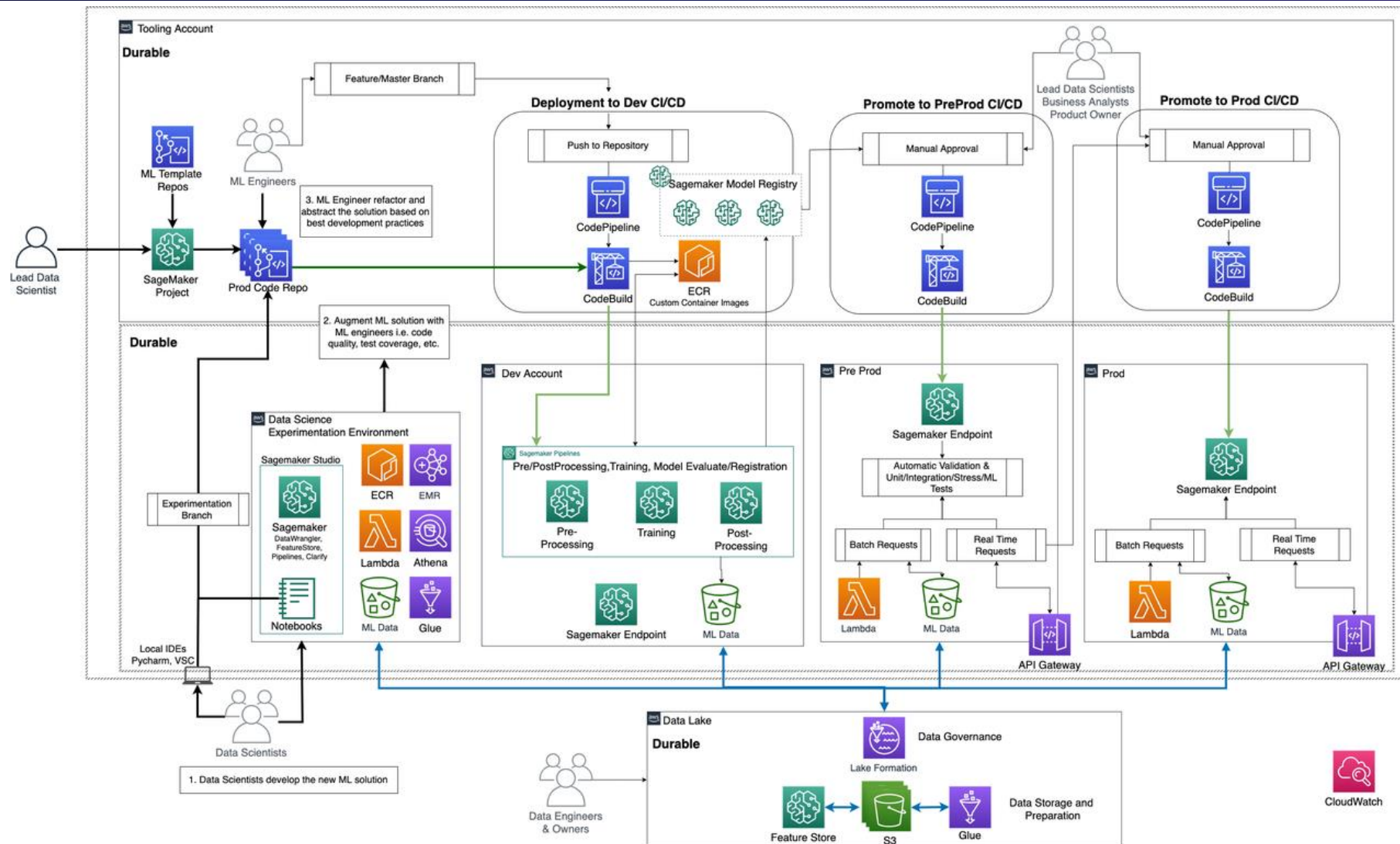
# MLOPs Reliable Phase 1/2

UNDERSTAND THE NEEDS OF MLOPS & INTRODUCE AUTOMATED TESTING



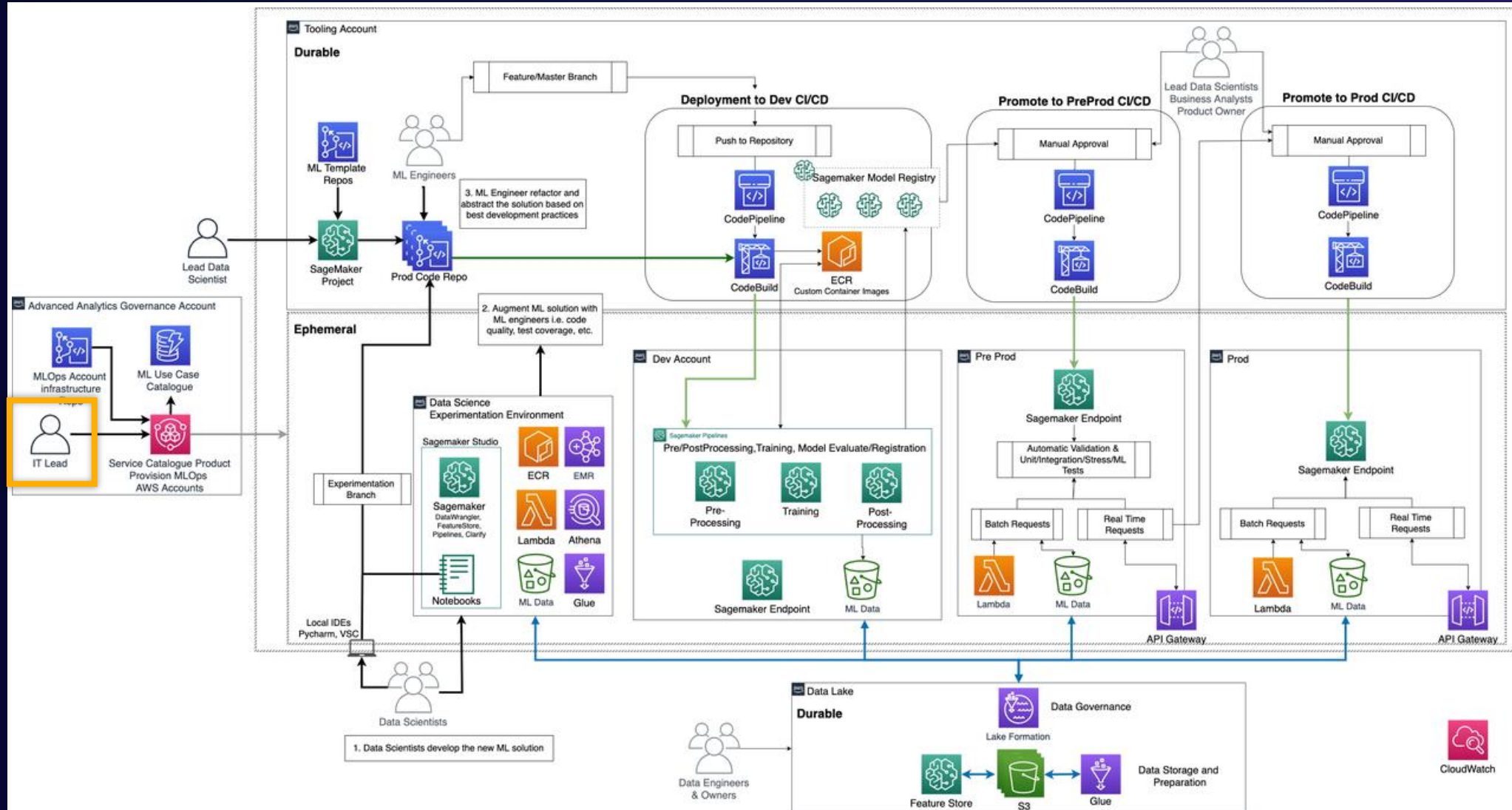
# MLOPs Reliable Phase 2/2

## BEST PRACTICE ON MLOPS, ROBUST AND SECURE MODELS



# MLOPs Scalable Phase

MULTIPLE TEAMS AND ML USE CASES ADOPT MLOPS





# Demo:

# Data Scientist & MLOps on AWS





NatWest  
Group

# The NatWest Group MLOps journey



# NatWest Group champions potential

HELPING PEOPLE, FAMILIES AND BUSINESSES TO THRIVE



[NatWest Group 2021 Results](#)

NatWest Group is the UK's leading business bank, and we serve **19 million customers** across the UK.

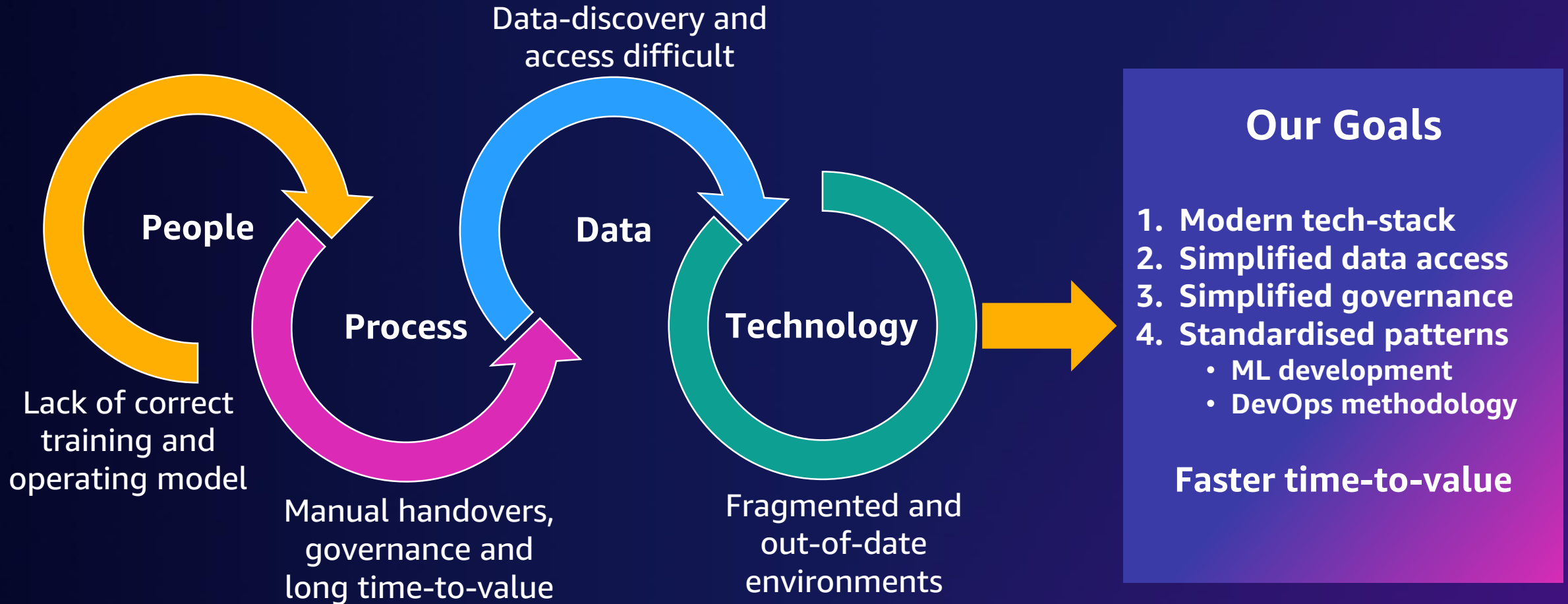
**~60k**  
staff worldwide

**~3000**  
models

**~500**  
data scientists and data engineers –  
continuing to grow



# NatWest Group challenges before MLOps

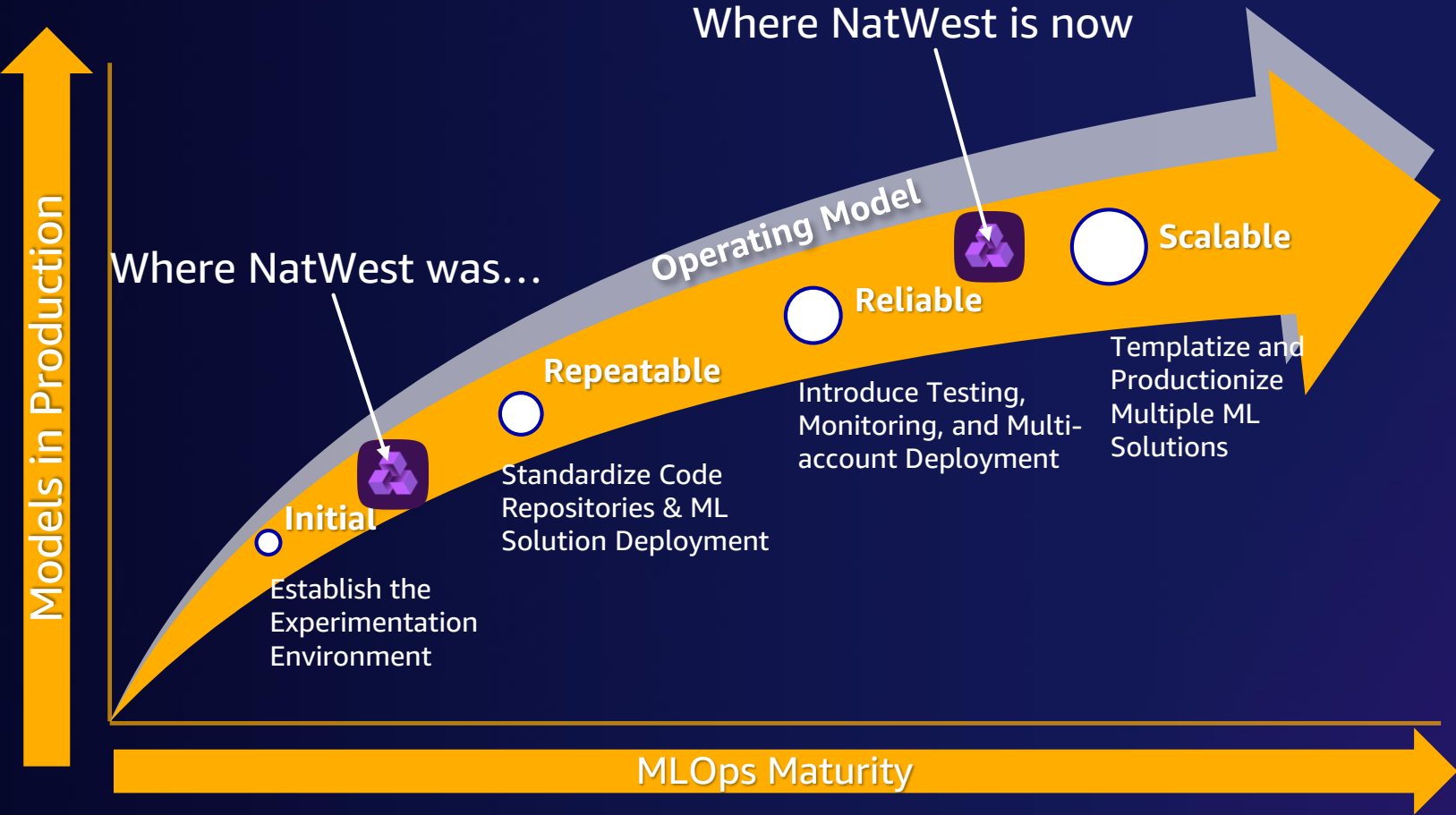


# What have we delivered in NatWest Group?

OUR MLOPS VISION, REALISED



# A metric-based approach focused on business value

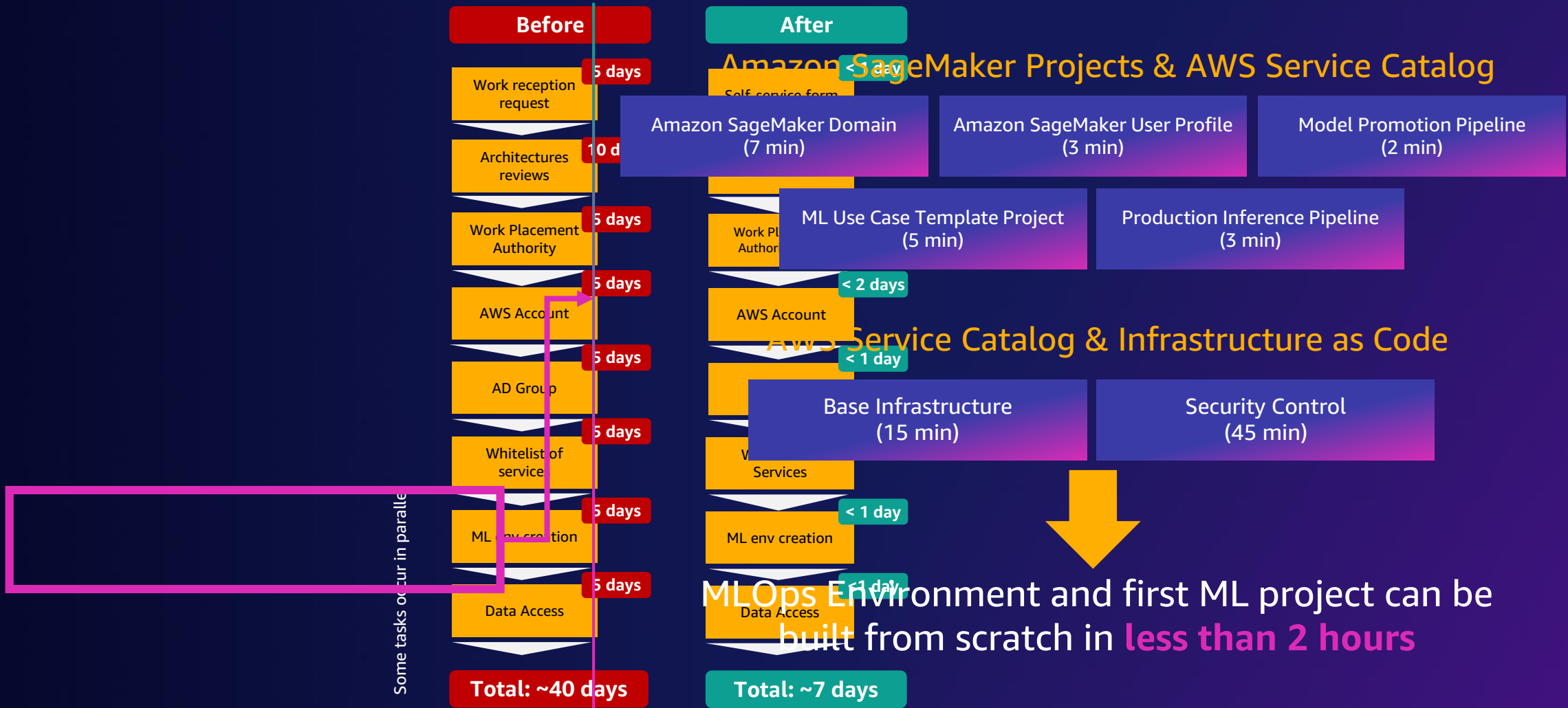


Metric	Where NatWest was...	Where NatWest is now
Faster delivery of end-to-end solutions	~12 months	< 3 months
Simplified discovery and access to data	~5 days	< 1 day
Simplified ML-model route-to-live	3-6 months	< 2 weeks
End-user self-service environment creation	> 30 days	< 2 hours
Reduce number of disparate model execution patterns	Many	< 5

\* Other metrics also used during project delivery

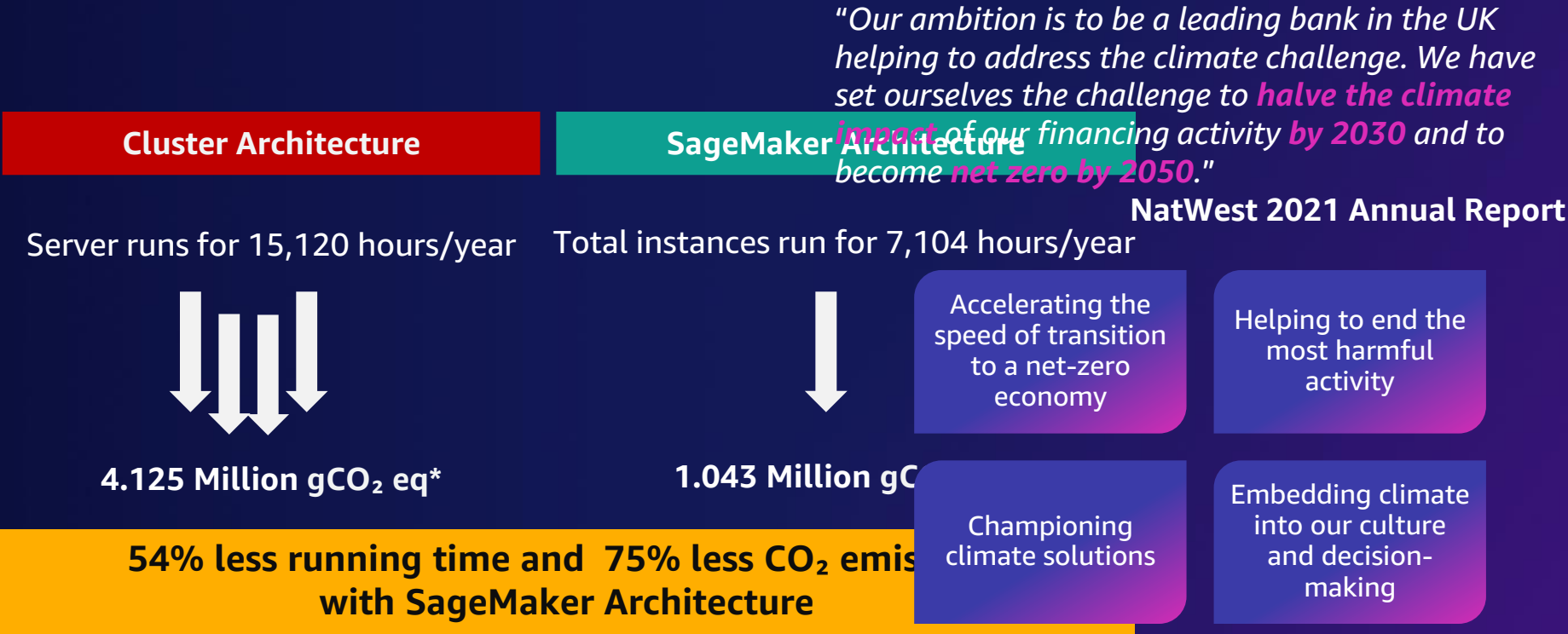
# Reduced operational overheads

NATWEST GROUP CAN NOW SPIN UP ML INFRASTRUCTURE IN <1 DAY VS 5 DAYS PREVIOUSLY



# MLOps on AWS Enables Sustainability

NATWEST GROUP MLOPS PLATFORM BECAME SERVERLESS AND REDUCED CO2 EMISSIONS



\* Calculated using <https://engineering.teads.com/sustainability/carbon-footprint-estimator-for-aws-ins>



“ **The partnership with AWS has helped us transform our ability to build ML products and services at *scale*. We are now working to grow this capability and embed it *across the organisation*. Through this work we have *simplified* our data fabric, *demonstrated* that we can deliver *data-driven insights faster* and have shown how we can use cloud technology to ultimately *delight our customers* as we support them at every stage of their lives.** ”

**Zachery Anderson**

Chief data & analytics officer, NatWest Group



**NatWest**  
Group

# Thank you!

Dr Sokratis Kartakis

 /in/sokratis-kartakis



Dr Greig Cowan

 /in/greigcowan





# Learn in-demand AWS Cloud skills



## AWS Skill Builder

Access **500+ free** digital courses and Learning Plans

Explore resources with a variety of skill levels and **16+** languages to meet your learning needs

Deepen your skills with digital learning on demand



Train now



## AWS Certifications

Earn an industry-recognized credential

Receive Foundational, Associate, Professional, and Specialty certifications

Join the **AWS Certified community** and get exclusive benefits



Access **new** exam guides



Please complete  
the session survey