
AWS
re:Invent

AIM304

Detect machine learning (ML) model drift in production

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AWS

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Agenda

Amazon SageMaker

Why monitor ML models in production?

Amazon SageMaker Model Monitor

Model Deployment and Monitoring Flow

Detect Data and Accuracy Drift

Act on Drift Detection

Demo Notebook



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Amazon SageMaker helps you build, train, and deploy models



Collect and prepare training data
Fully managed data processing jobs/ data labeling workflows

Choose or bring your own ML algorithm
Collaborative notebooks, built-in algorithms/models







Deploy model in production
One-click deployment and auto-scaling



Monitor models
Automatically spot concept drift



Validate predictions
Add human review of predictions

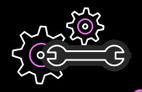


Scale and manage the production environment
Fully managed with auto-scaling for 75% less

Set up and manage environments for training
One-click training



Train, debug, and tune models
Debugging and optimization



Manage training runs
Visually track and compare experiments



WEB-BASED IDE FOR ML AUTOMATICALLY BUILD AND TRAIN MODELS

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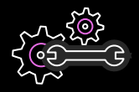


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Machine learning models In production



Deploying a model is not the end. You need to continuously monitor models in production and iterate.

Concept drift due to divergence of data

+

Model performance (accuracy) can change due to unknown factors

=

Continuous monitoring is critical

Amazon SageMaker Model Monitor
Continuous monitoring of models in production



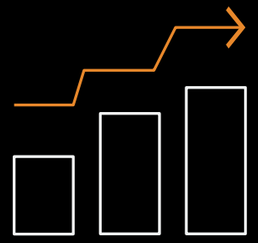
Automatic data collection



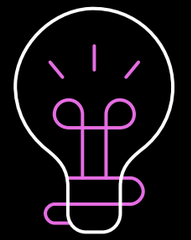
Continuous monitoring



Flexible monitoring rules

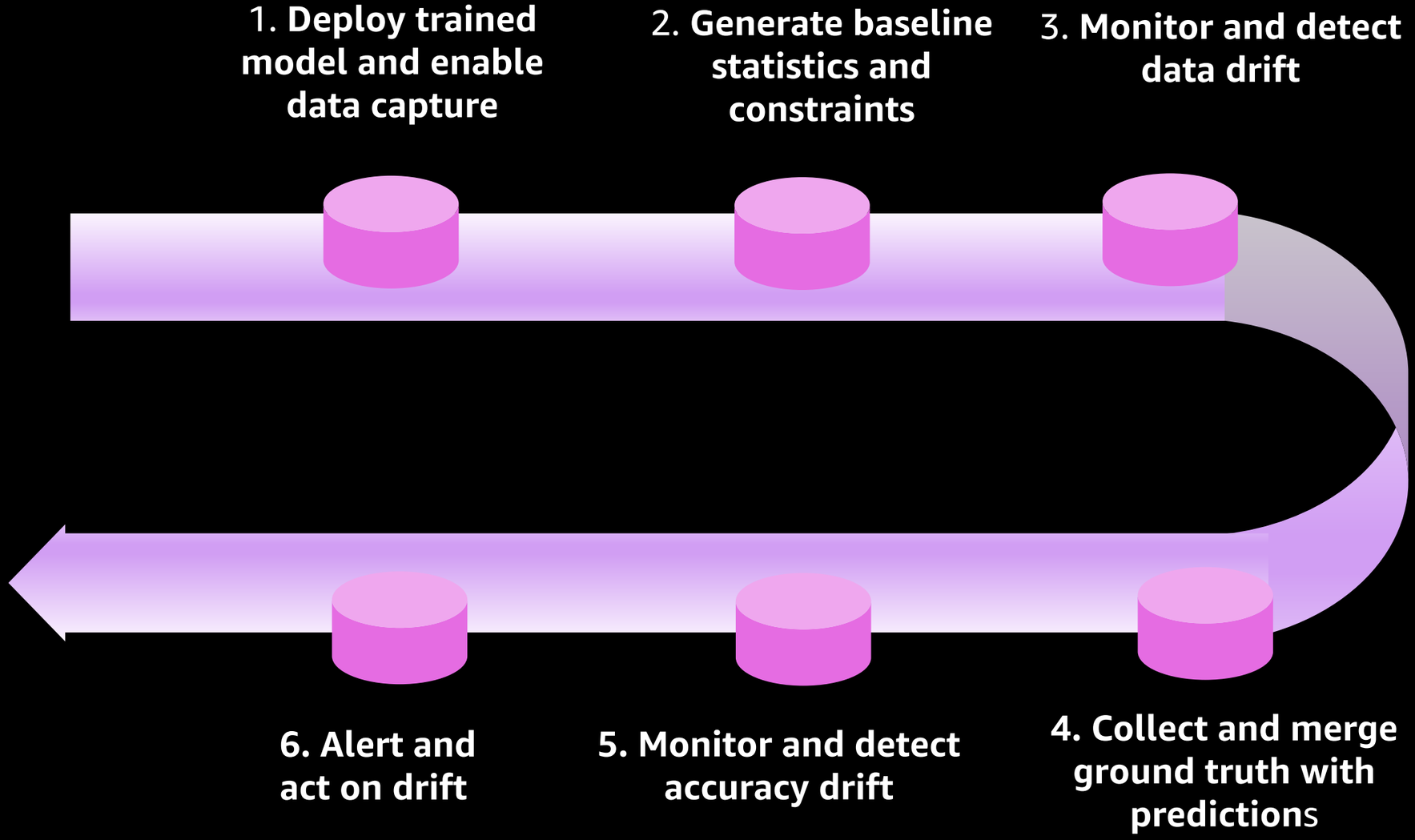


Visual data analysis

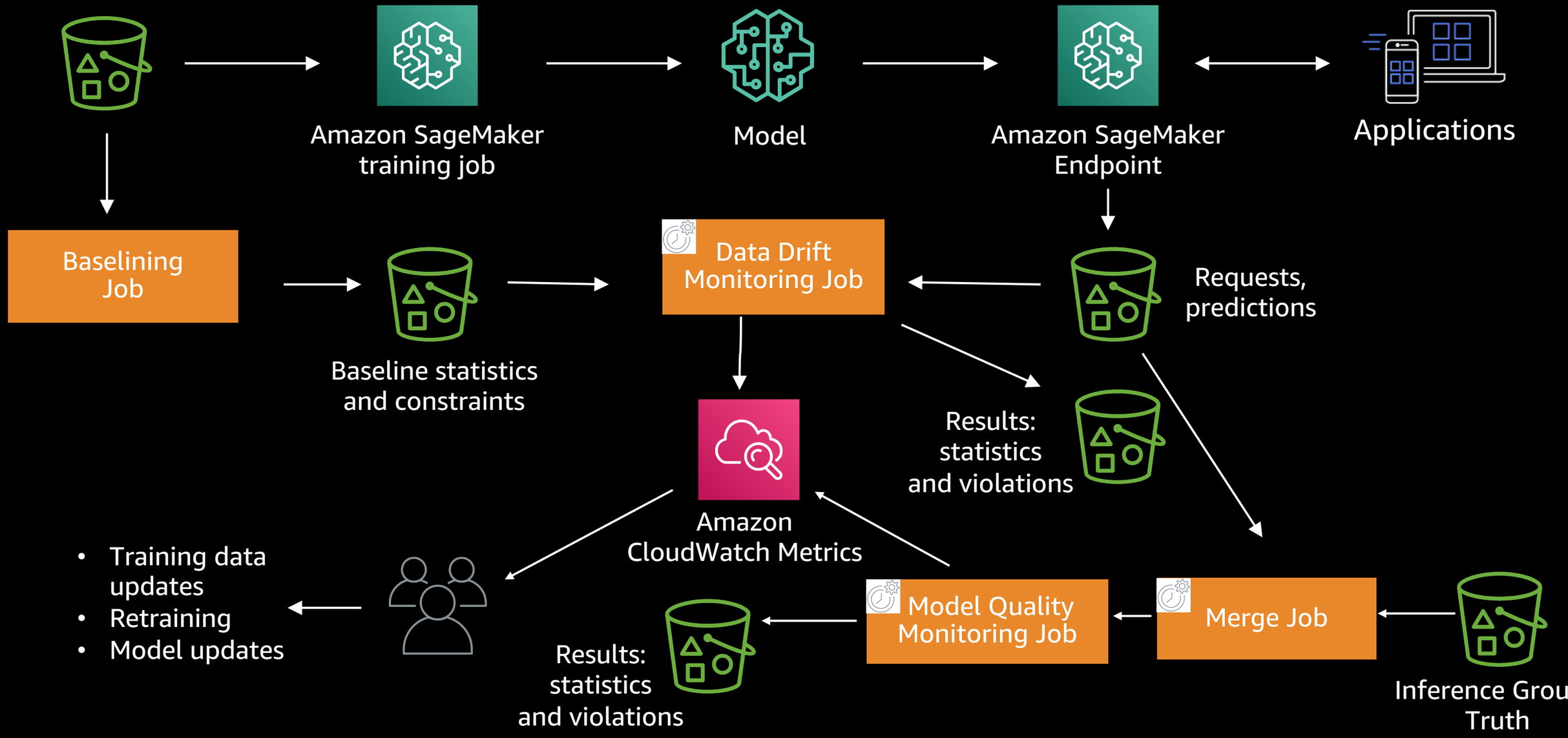


Amazon CloudWatch integration

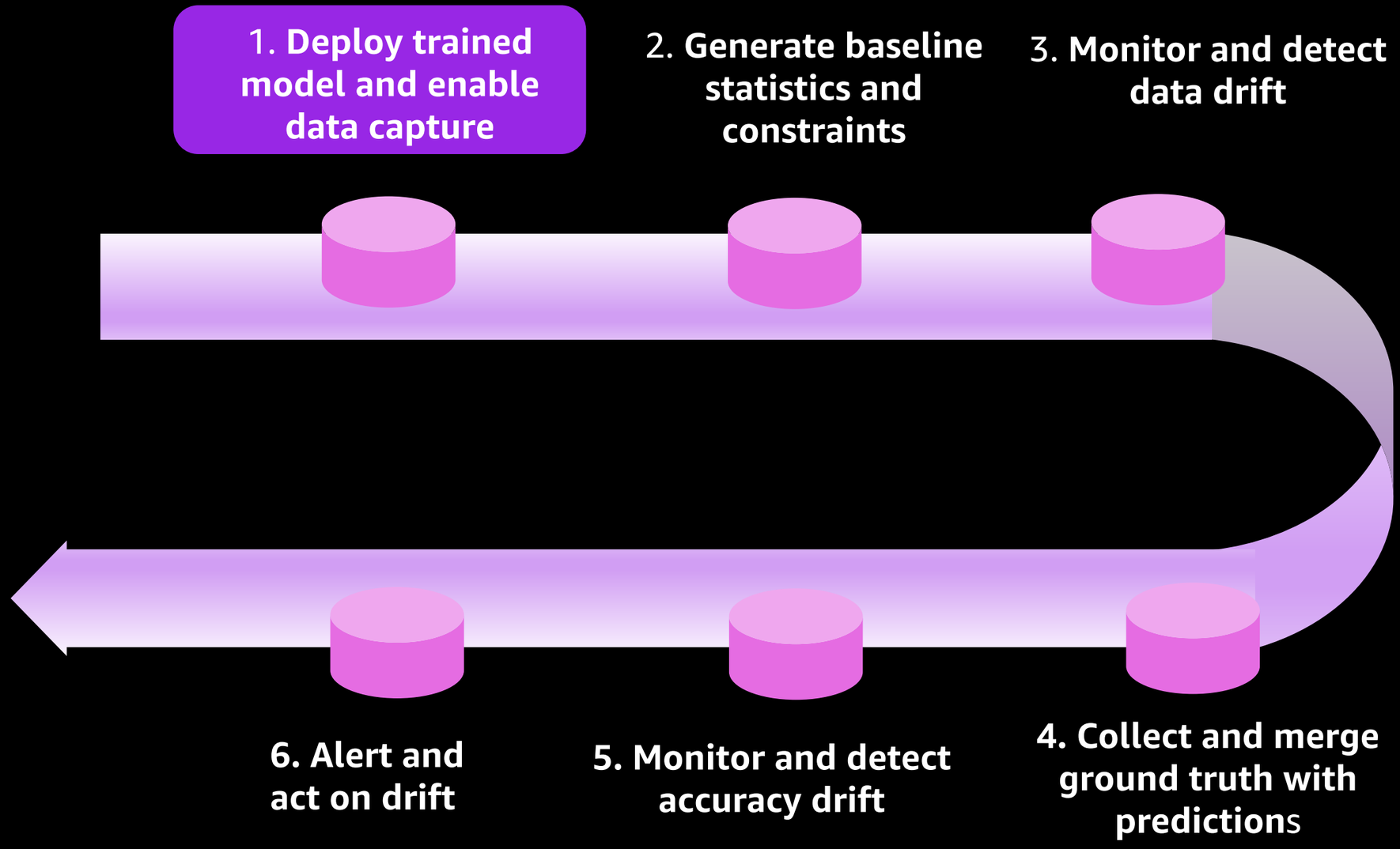
Amazon SageMaker Model Monitor
Model Deployment and Monitoring Flow



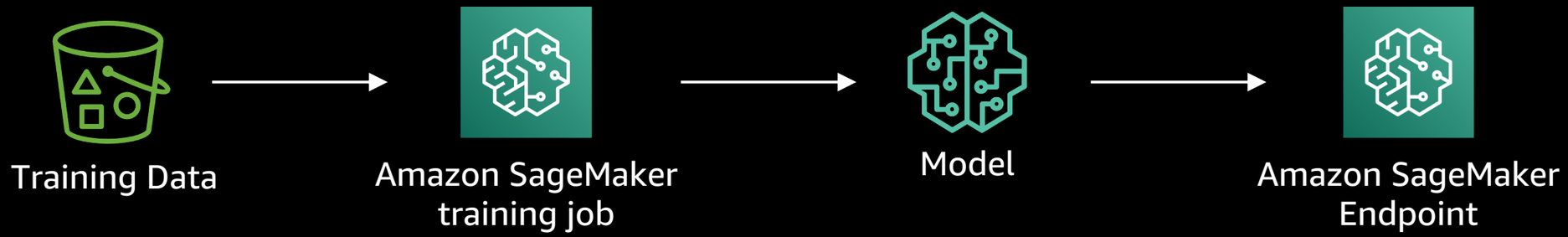
Model Deployment and Monitoring for Drift - Architecture



Amazon SageMaker Model Monitor
Model Deployment and Monitoring Flow

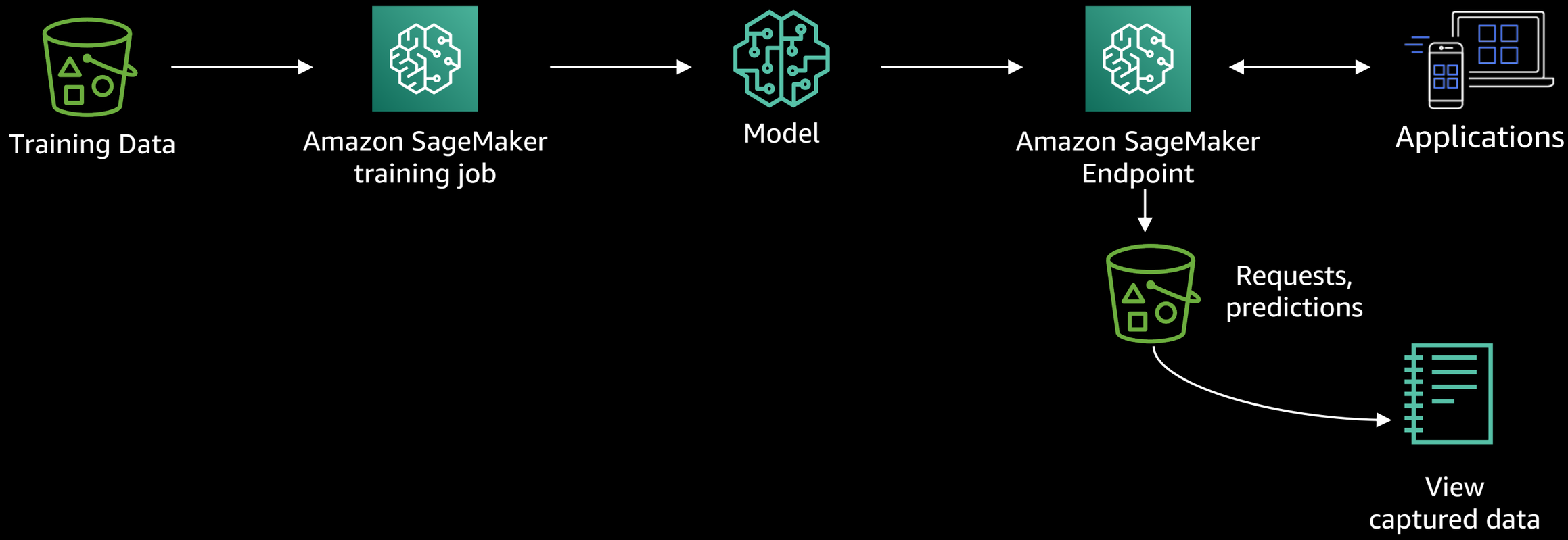


Deploy trained model and enable data capture

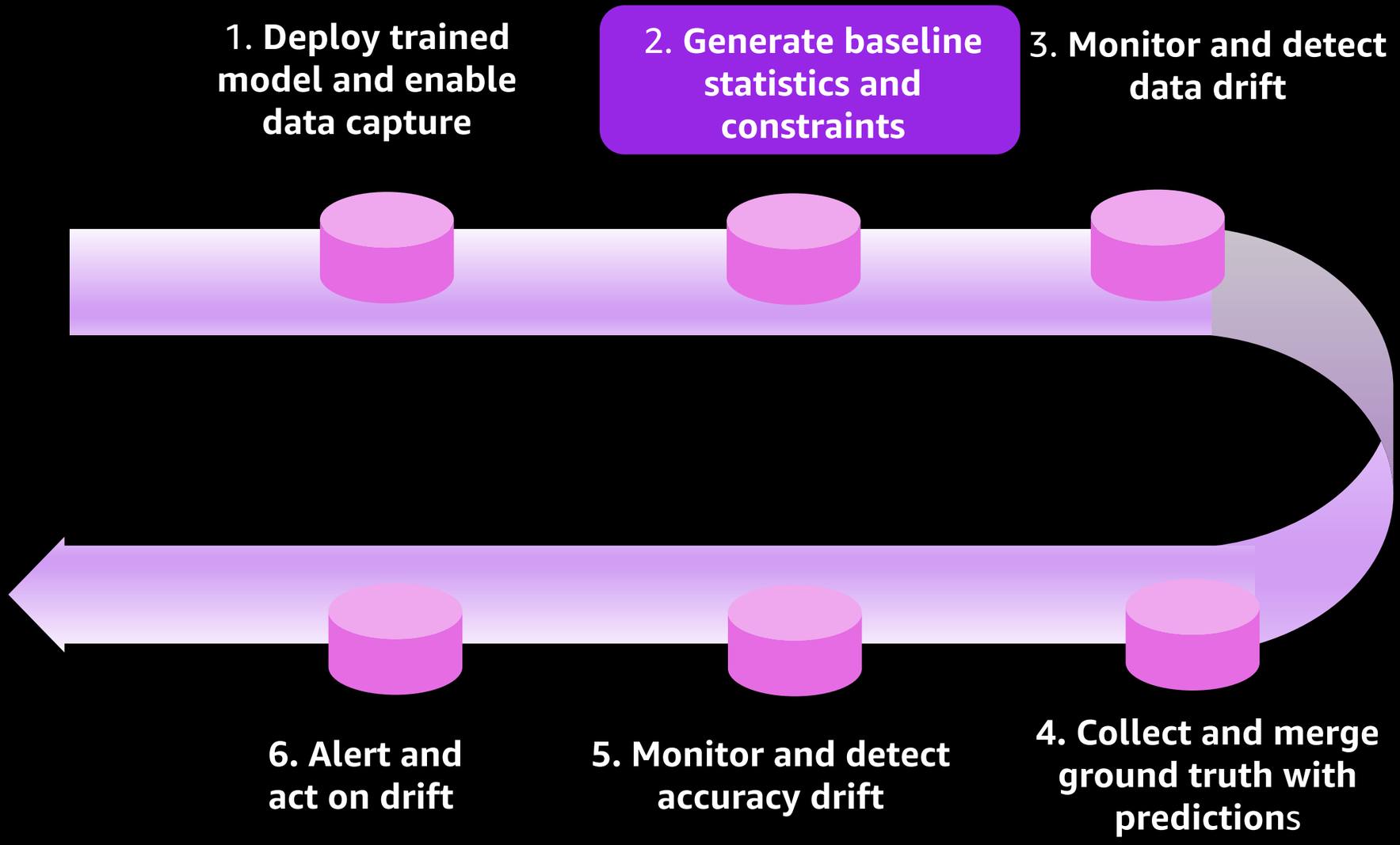


“EnableCapture” : true

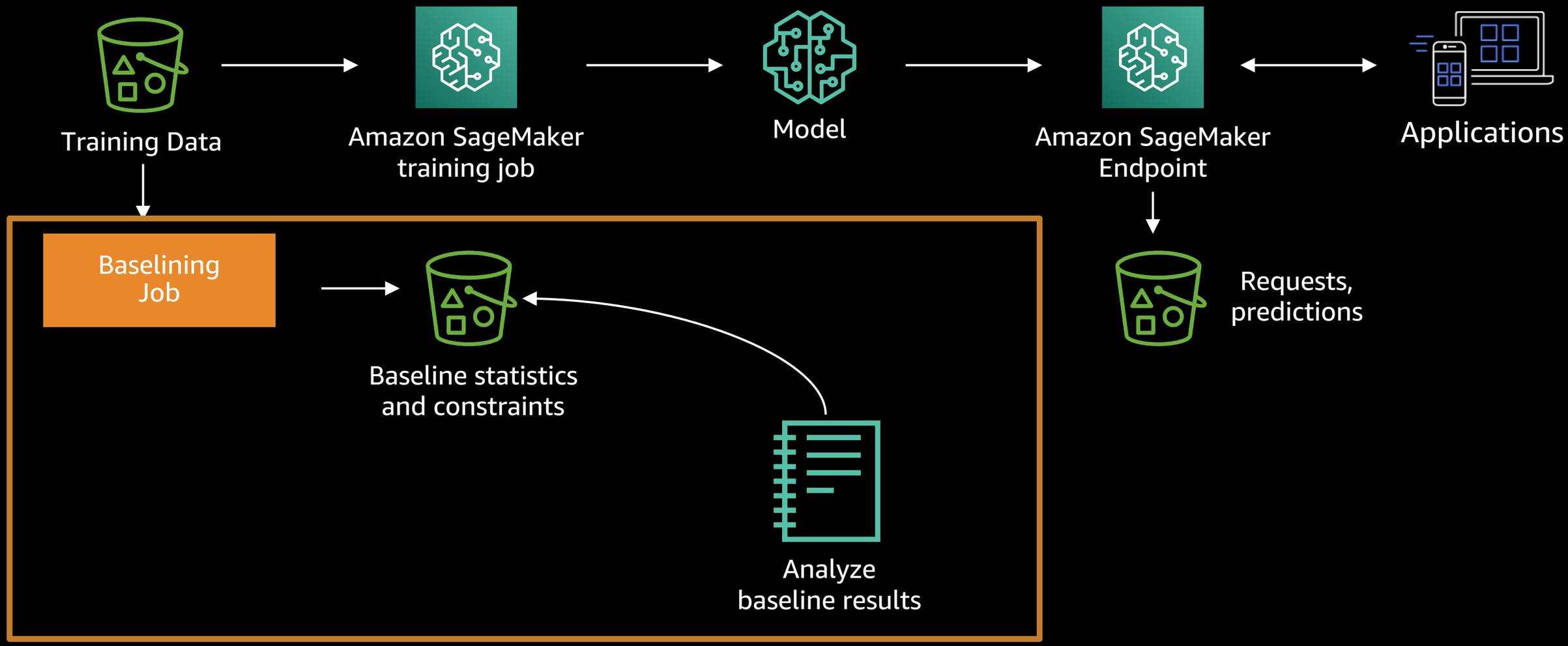
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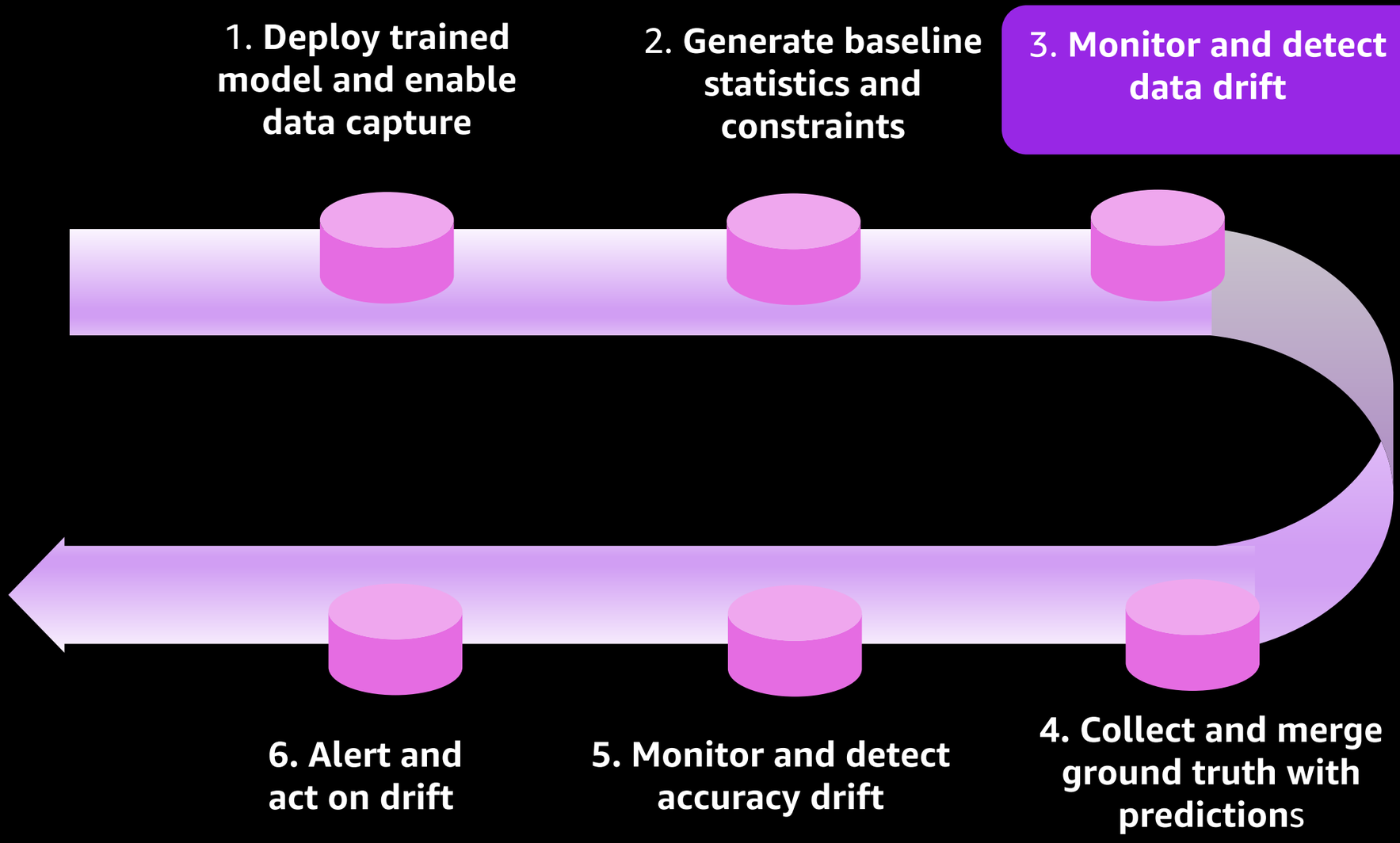
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Model Deployment and Monitoring Flow



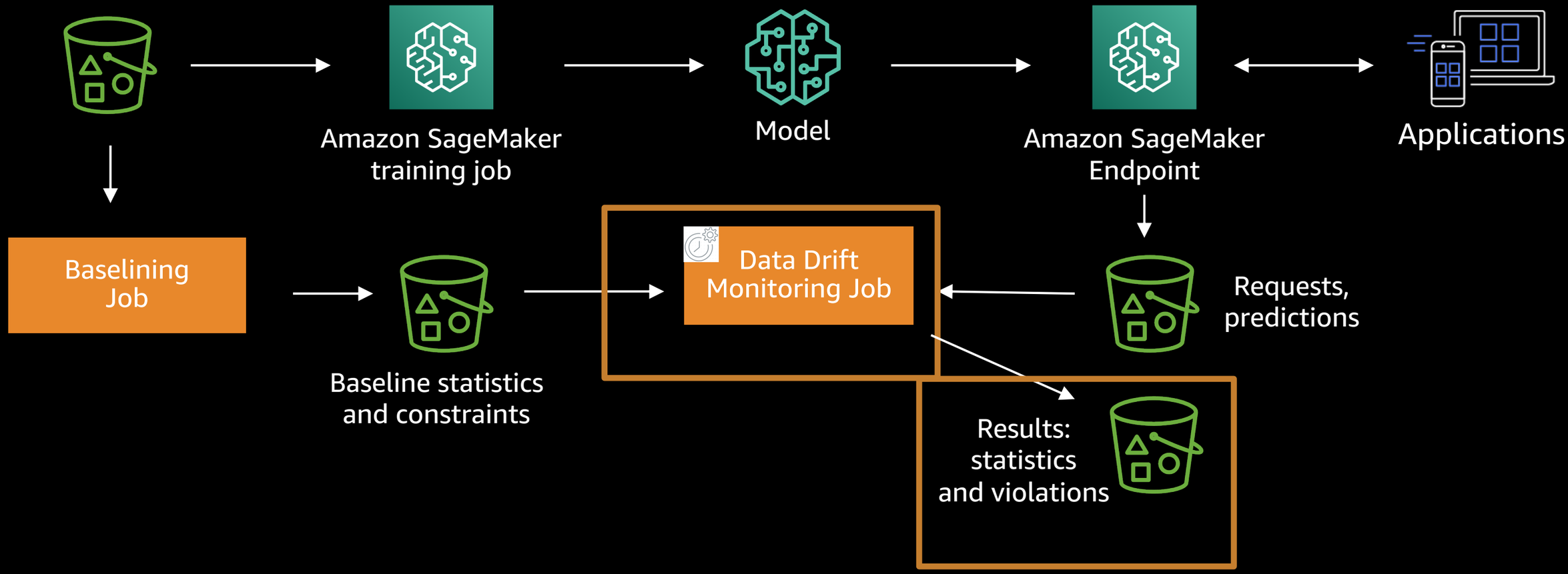
Generate baseline statistics and constraints



Amazon SageMaker Model Monitor
Model Deployment and Monitoring Flow



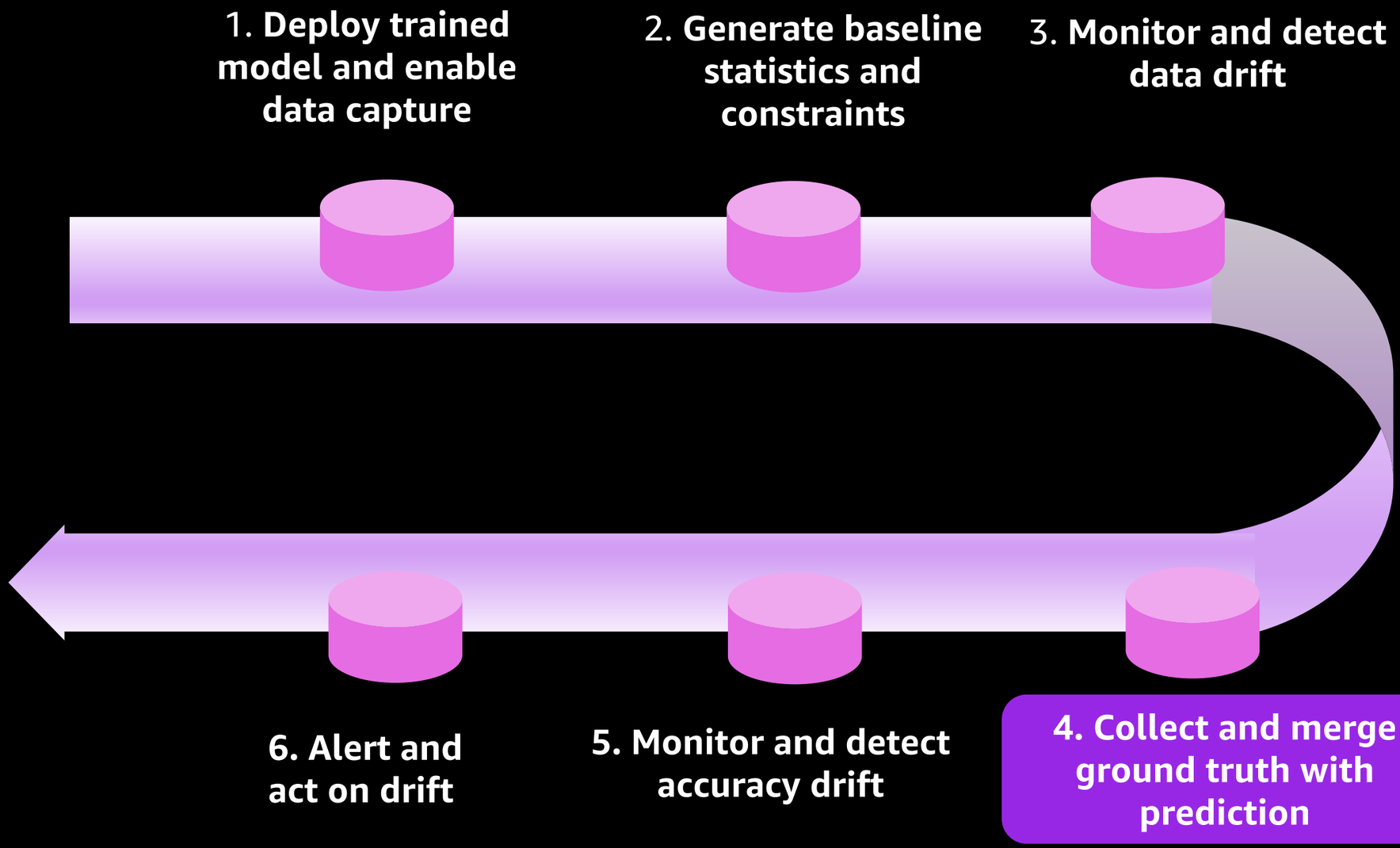
Monitor and detect data drift



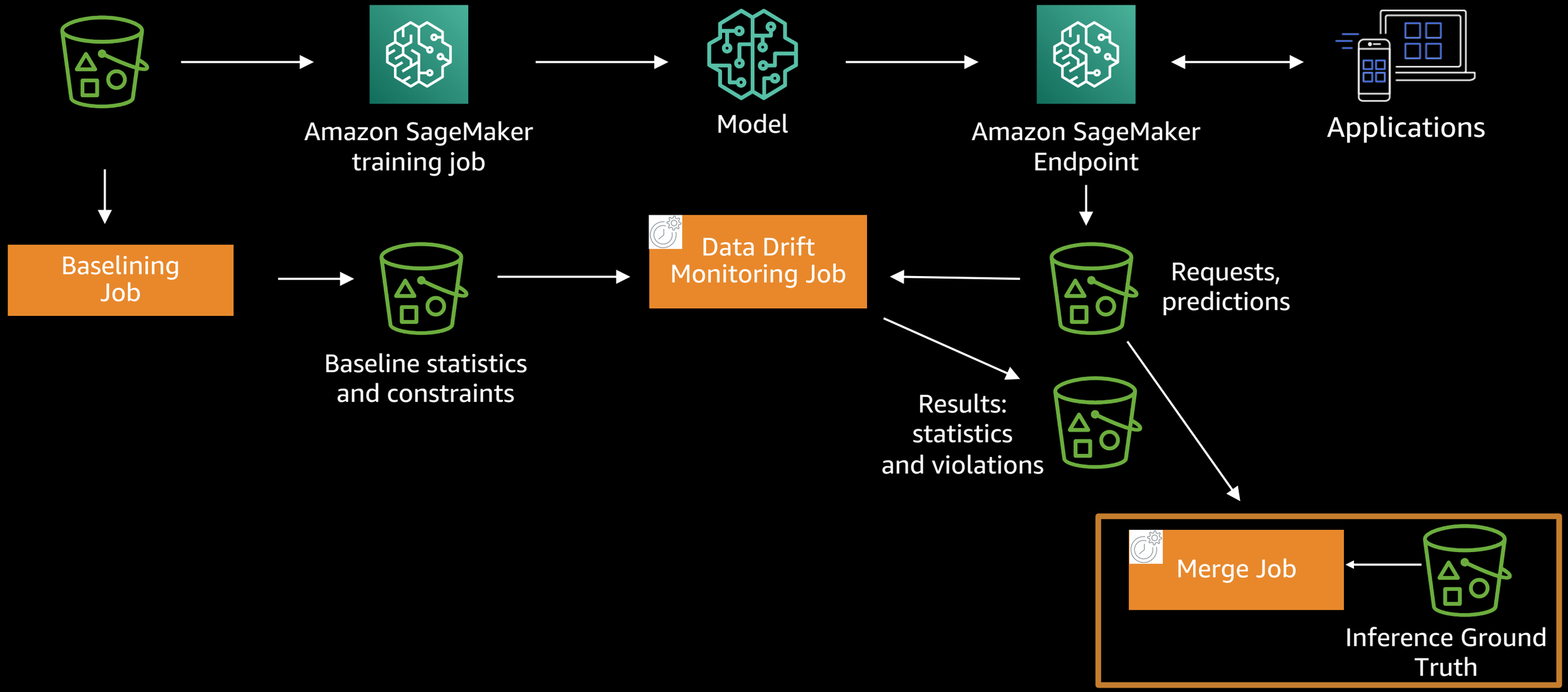
Built-in data drift metrics

- data_type_check — inferred vs observed data type
- completeness_check — completeness (% of non null items) > threshold
- baseline_drift_check — deviation > threshold
- missing_column_check — observed columns < baseline columns
- extra_column_check — observed columns > baseline columns
- categorical_values_check — observed unknown values > baseline unknown values

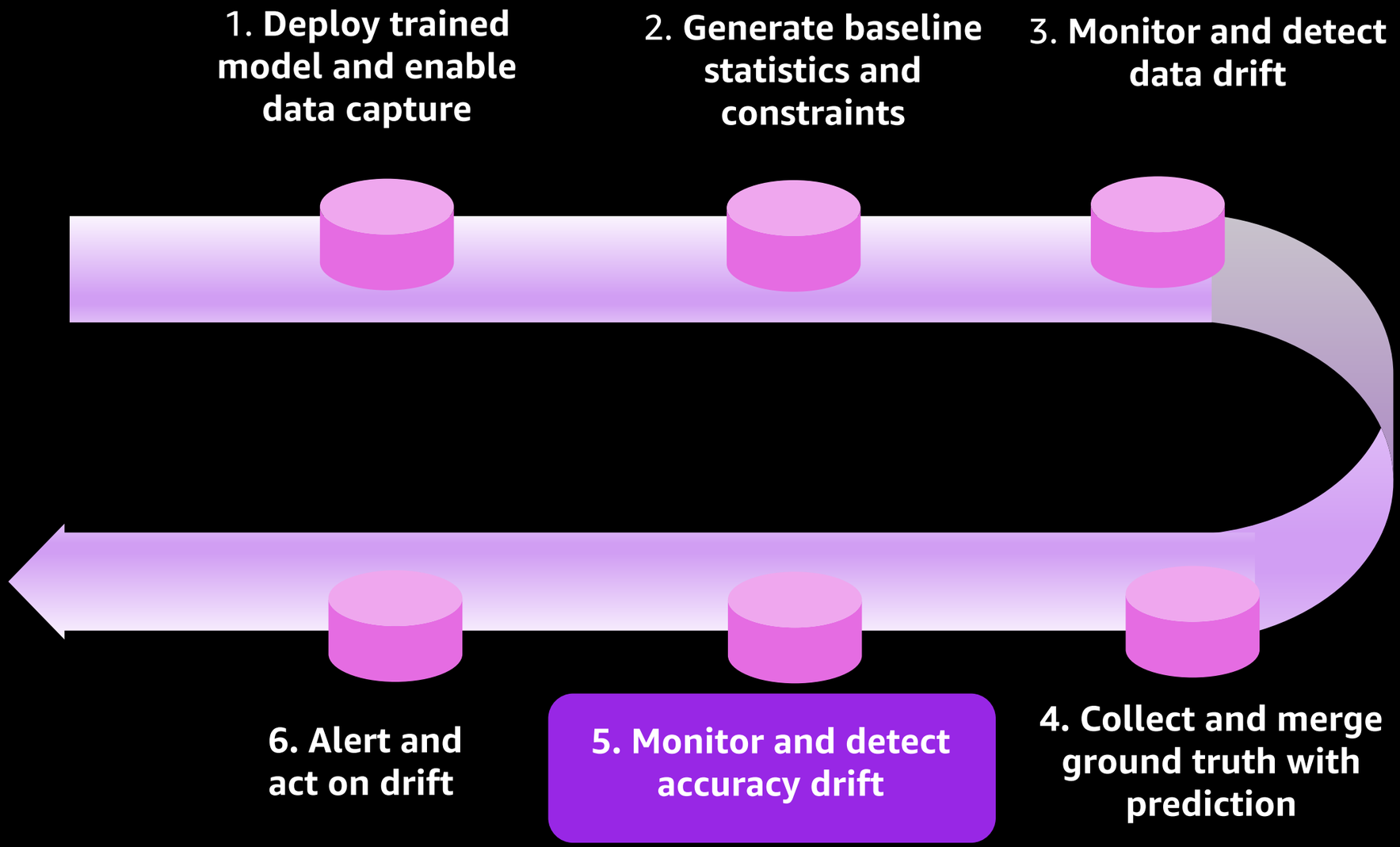
Amazon SageMaker Model Monitor
Model Deployment and Monitoring Flow



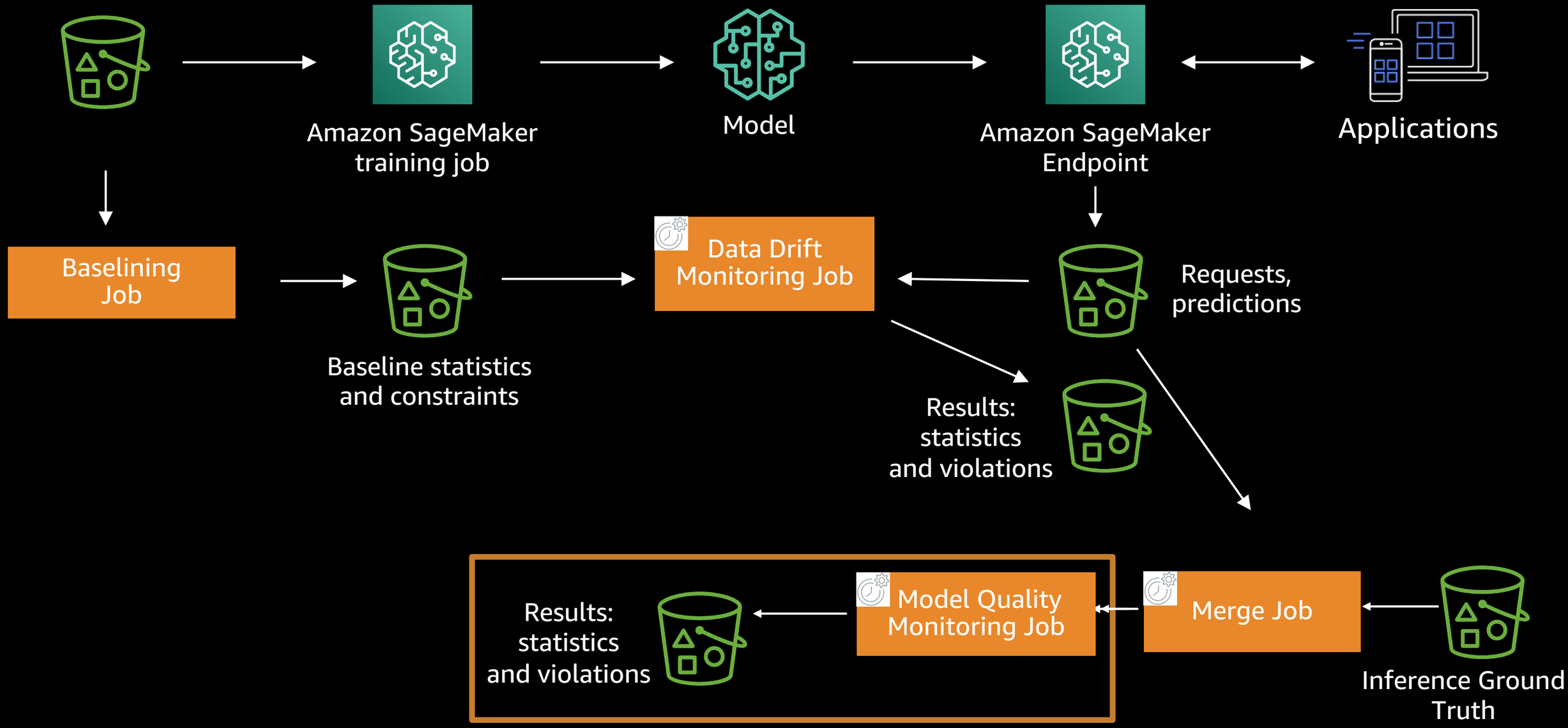
Collect and merge Ground Truth and predictions



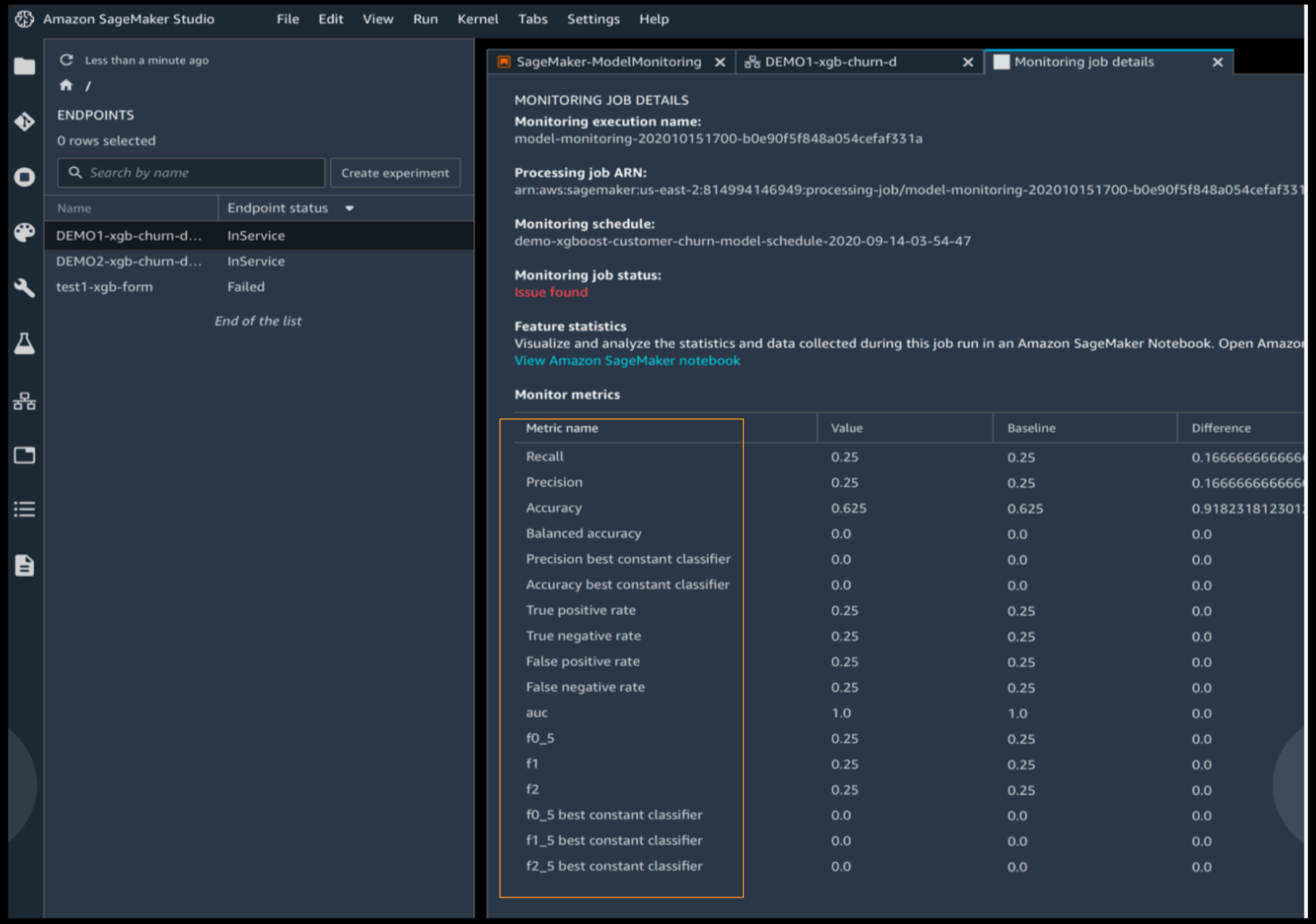
Amazon SageMaker Model Monitor
Model Deployment and Monitoring Flow



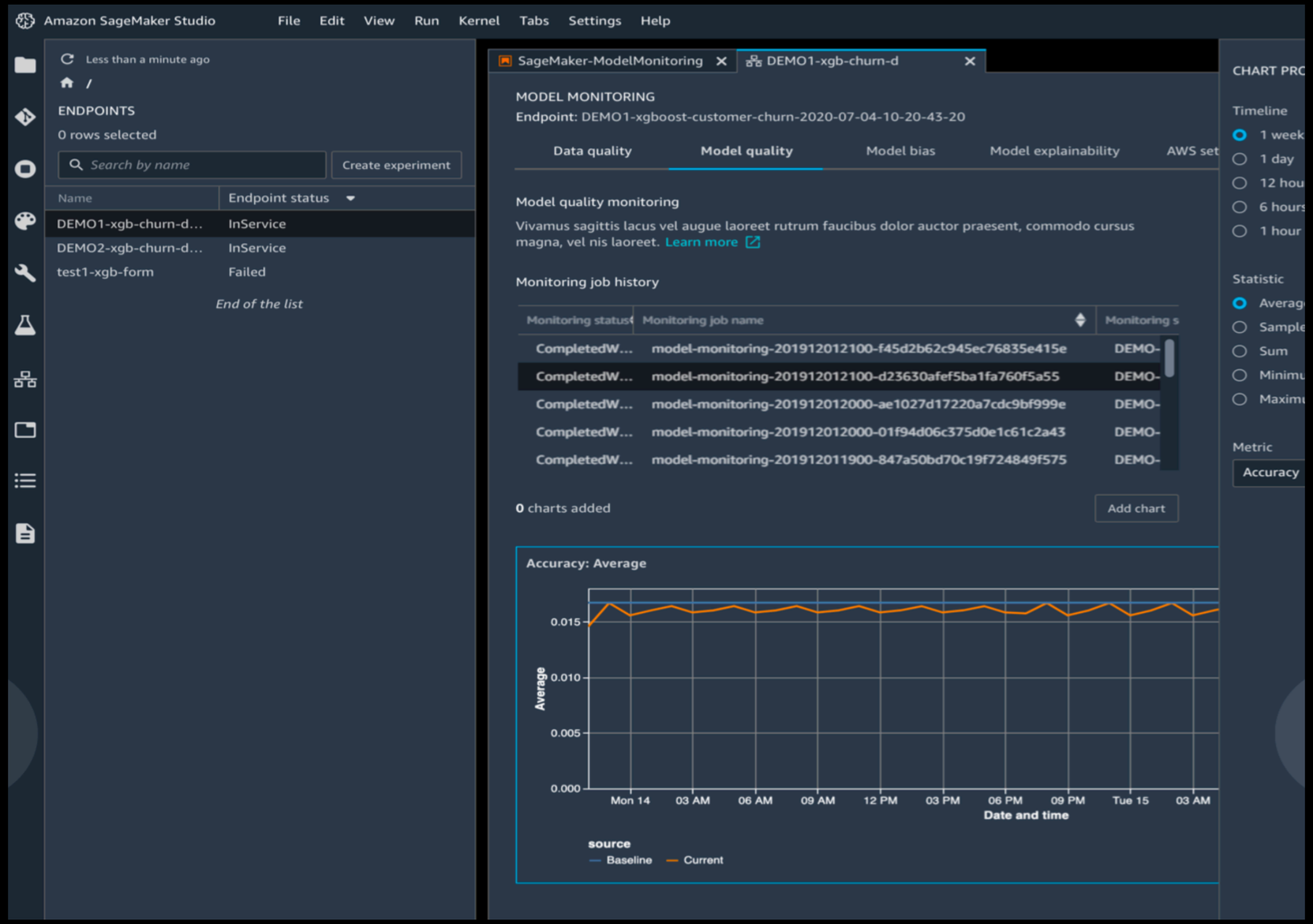
Monitor and detect accuracy drift



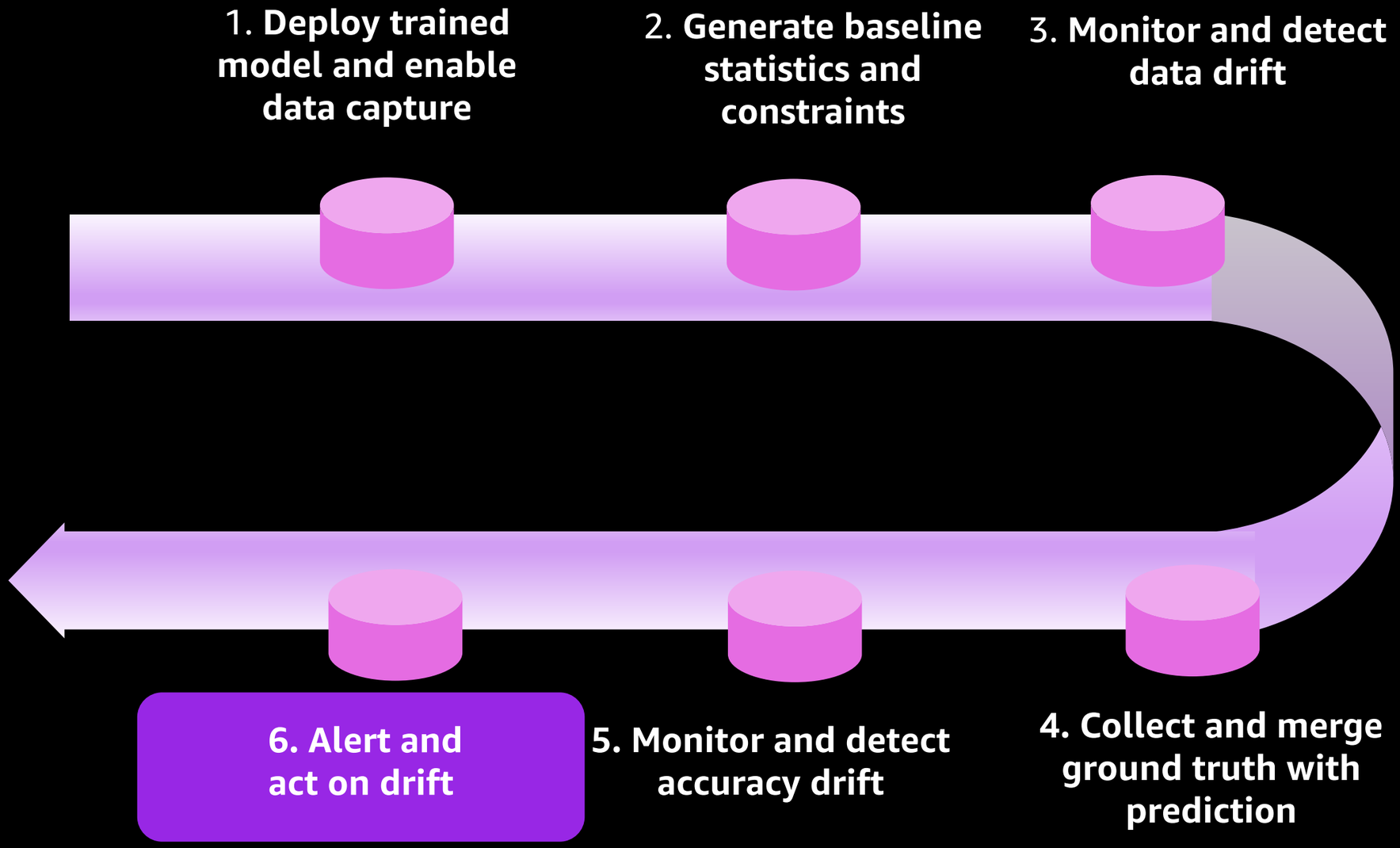
Built-in model quality metrics



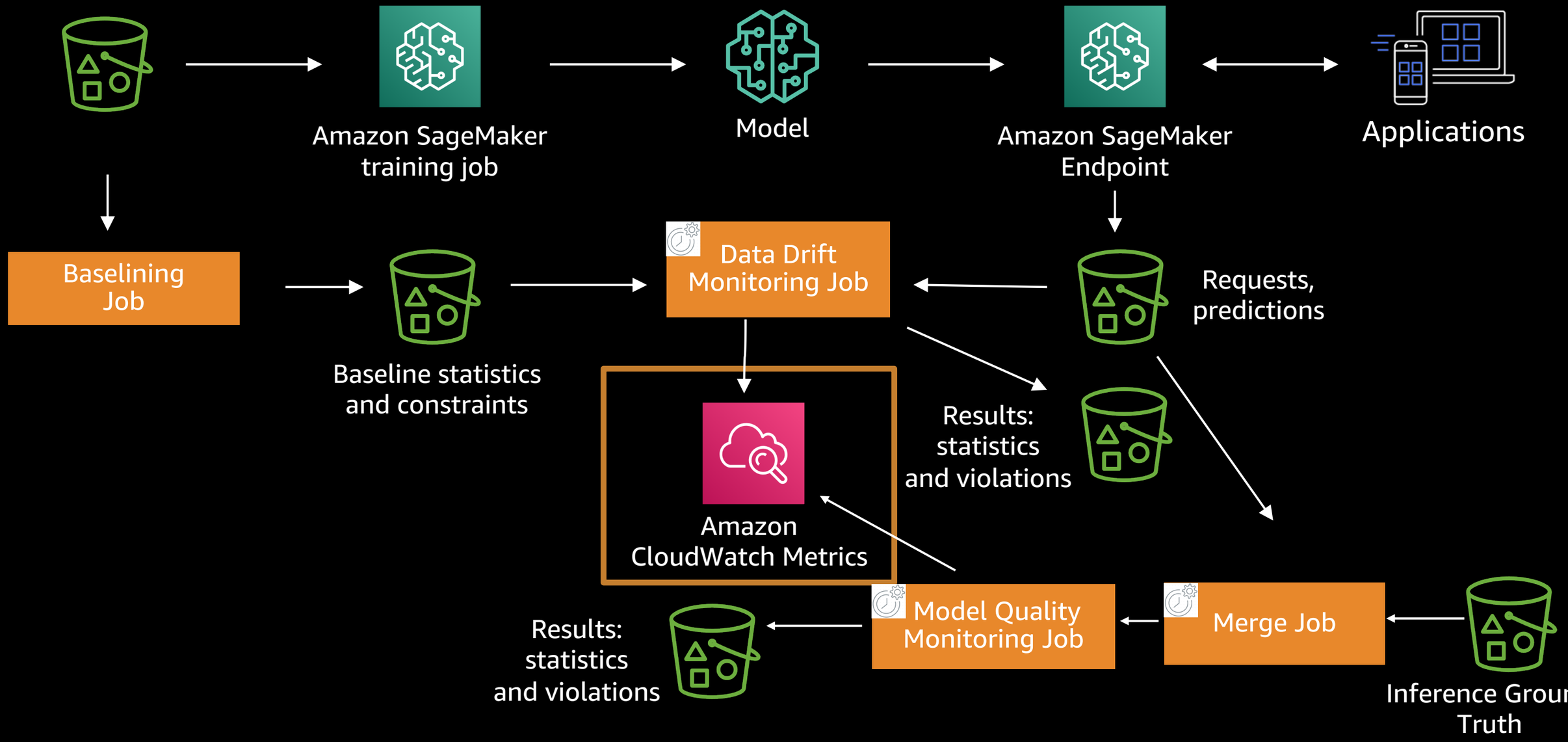
Built-in model quality metrics



Amazon SageMaker Model Monitor
Model Deployment and Monitoring Flow



CloudWatch Metrics



CloudWatch Metrics

Data Drift Monitoring Job

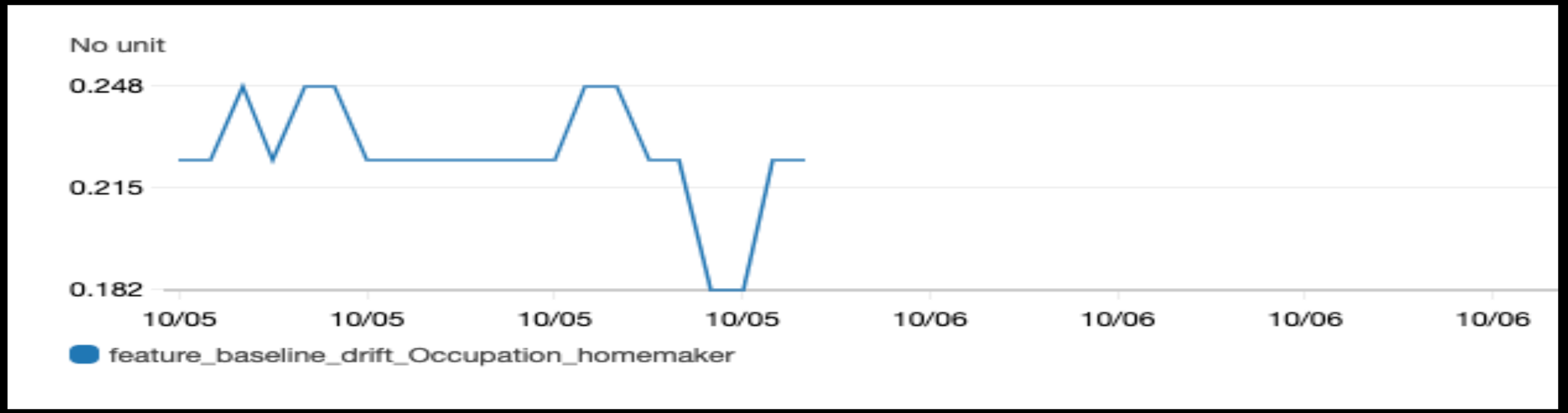
/aws/sagemaker/Endpoints/data-metric namespace with EndpointName and ScheduleName dimensions

Numerical Fields

- feature_data_{feature_name}
  - Metric : Max
  - Metric : Min
  - Metric : Sum
  - Metric : SampleCount
  - Metric:Average

Numerical and String Fields

- feature_non_null_{feature_name}
  - Metric: Completeness
- feature_baseline_drift_{feature_name}
  - Metric: BaselineDrift



CloudWatch Metrics

Model Quality Monitoring Job

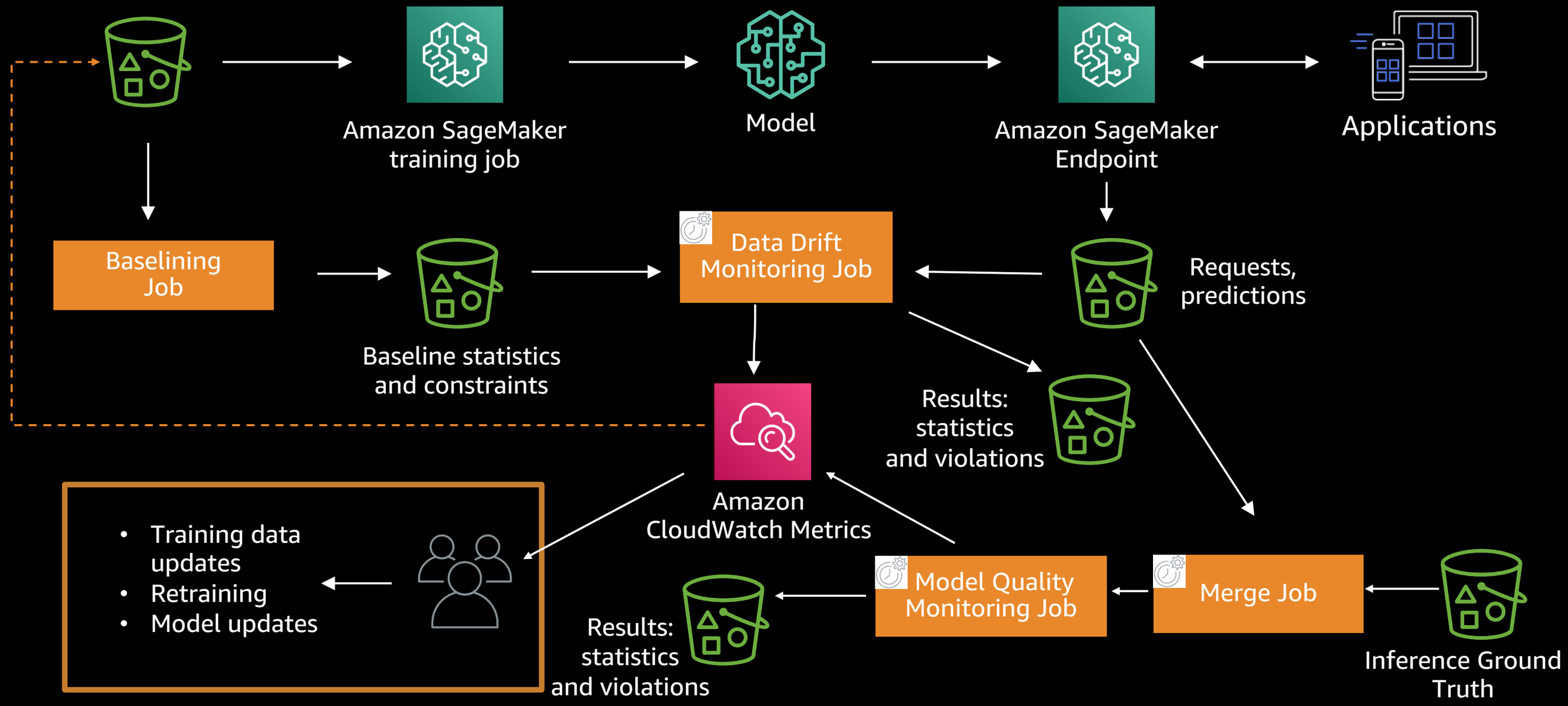
Numerical Fields

- Metric : AUC, Stat : Max
- Metric : AUC, Stat : Min
- Metric : AUC, Stat : SampleCount
- Metric : AUC, Stat : Average

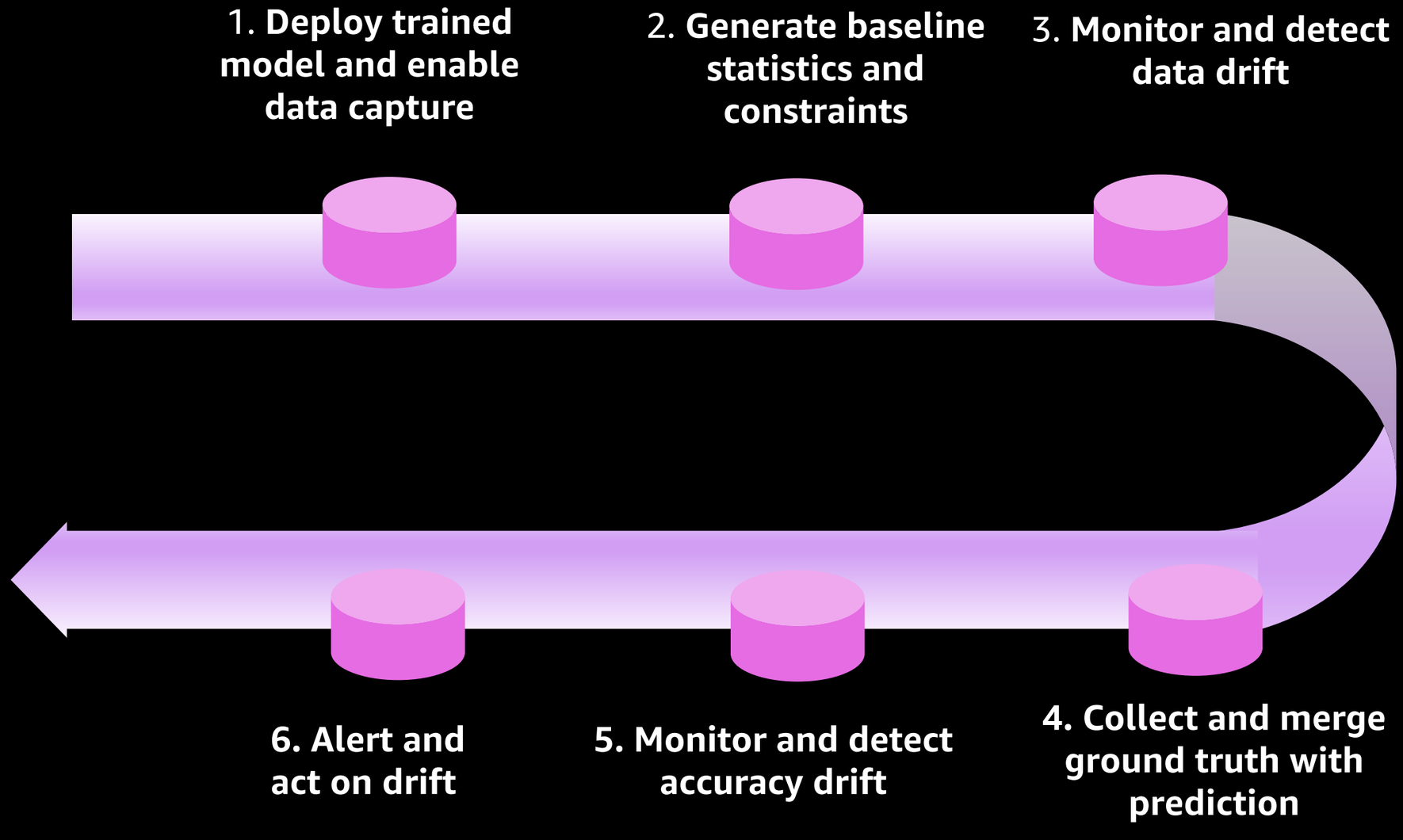
- Metric : F1, Stat : Max
- Metric : F1, Stat : Min
- Metric : F1, Stat : SampleCount
- Metric : F1, Stat : Average

More!

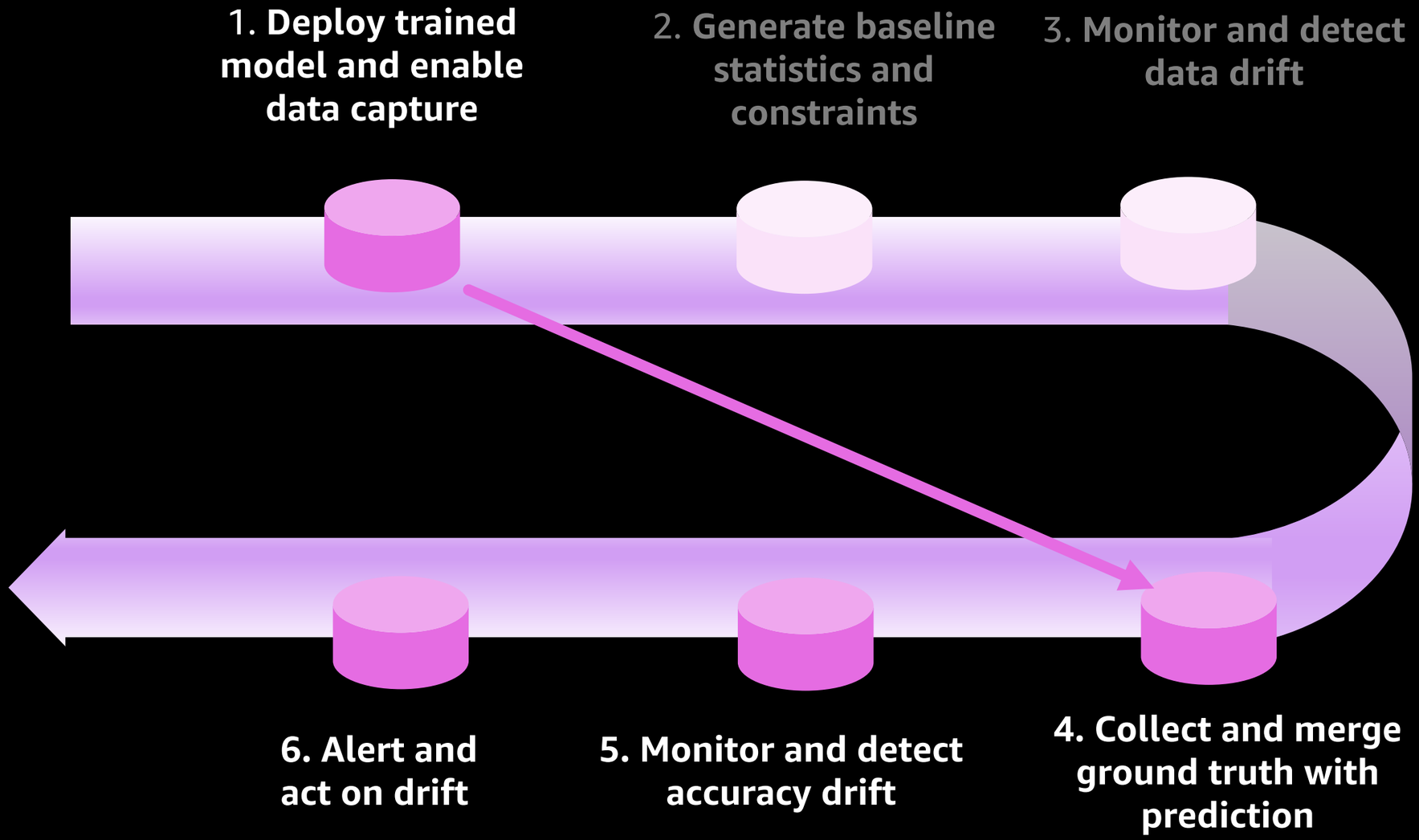
Act on the Drift Detection



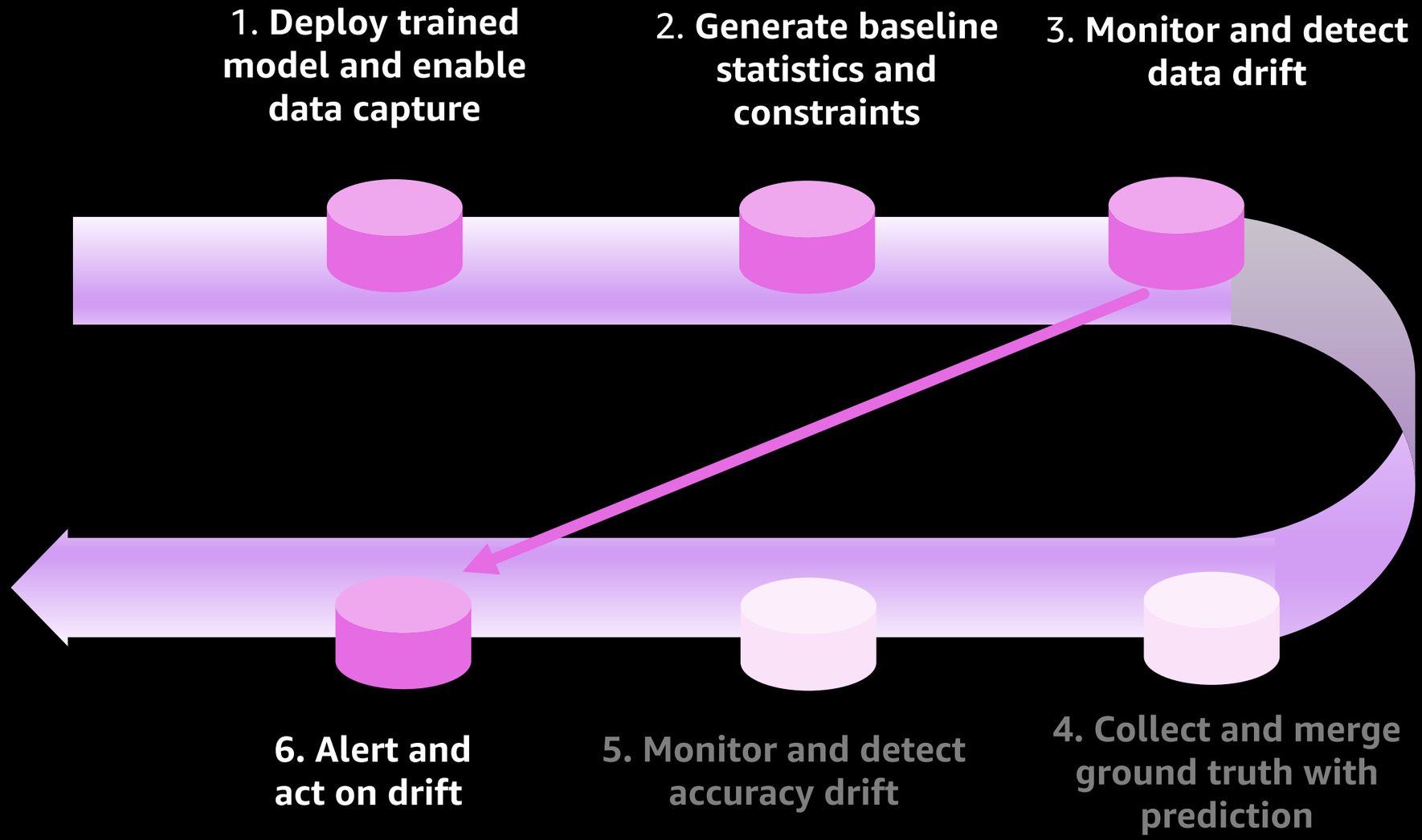
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