
AWS
re:Invent

AIM406

Implementing MLOps practices with Amazon SageMaker

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Agenda

- Intro
- Automating Amazon SageMaker workflows
- Building Amazon SageMaker CI/CD pipelines



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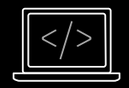
Intro



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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

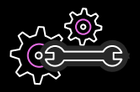


Scale and manage the production environment
Fully managed with auto-scaling for 75% less

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



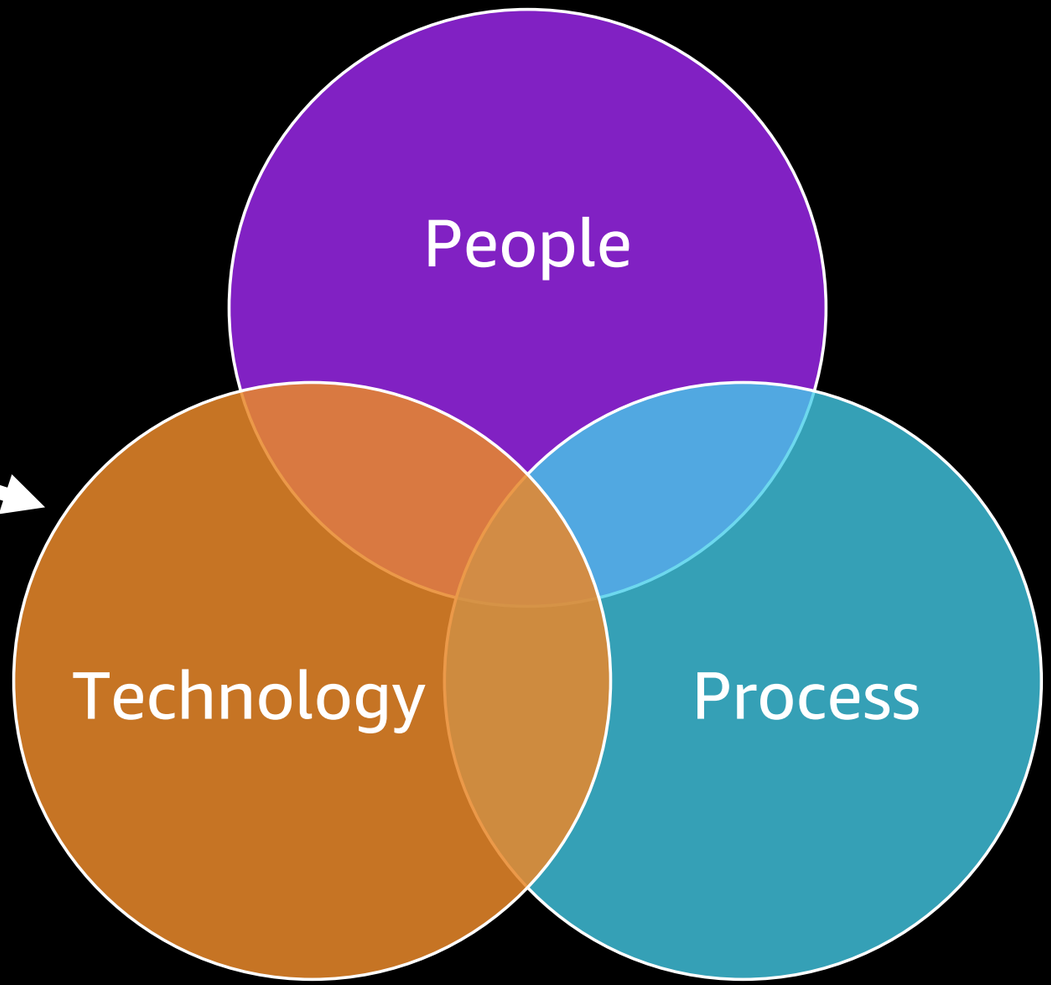
WEB-BASED IDE FOR ML

AUTOMATICALLY BUILD AND TRAIN MODELS

MLOps practices

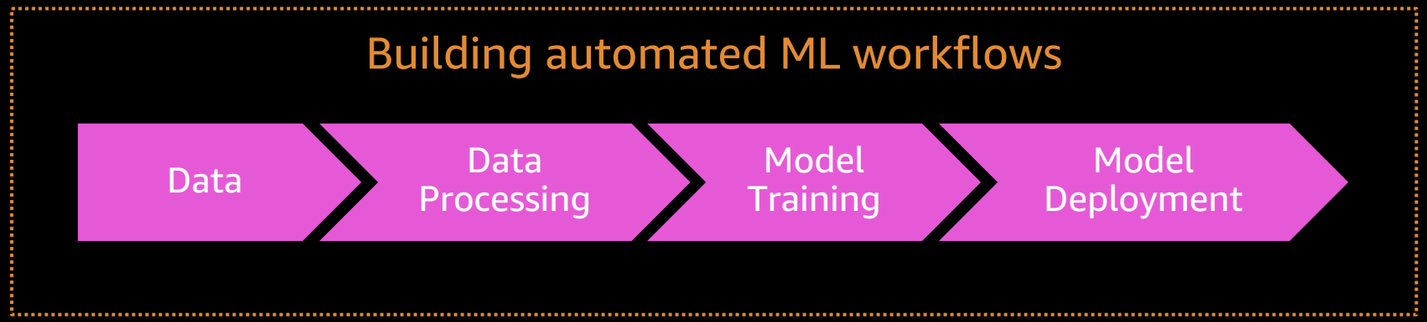
Session focus

- Automated workflows
- CI/CD pipelines

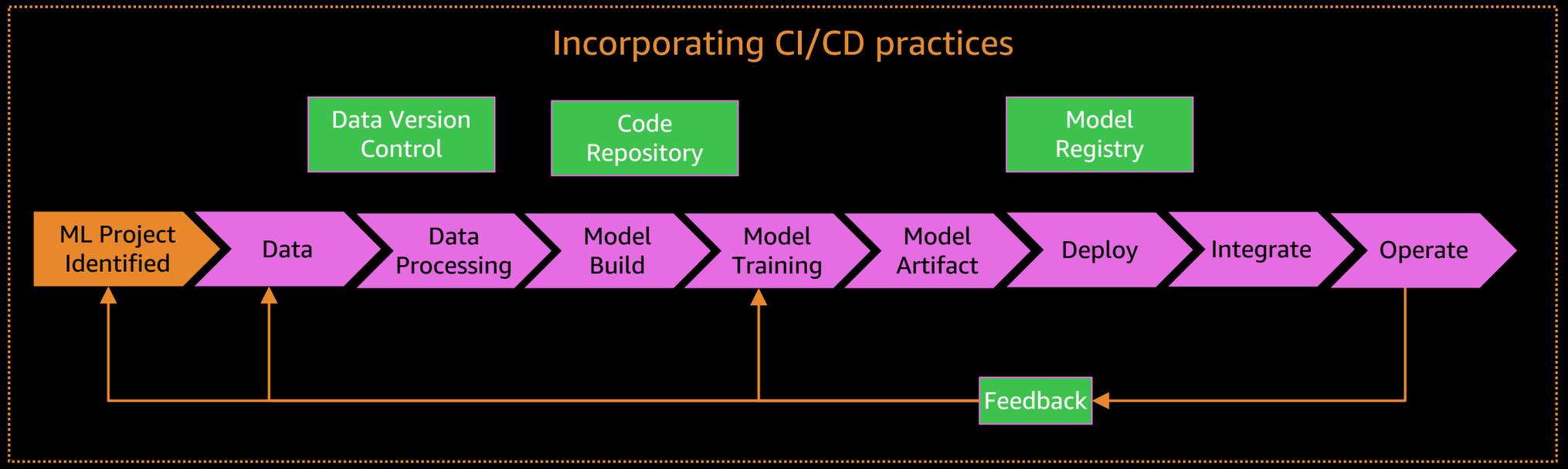


MLOps practices : Technology

Moving from…



to…



MLOps practices : The golden pipeline



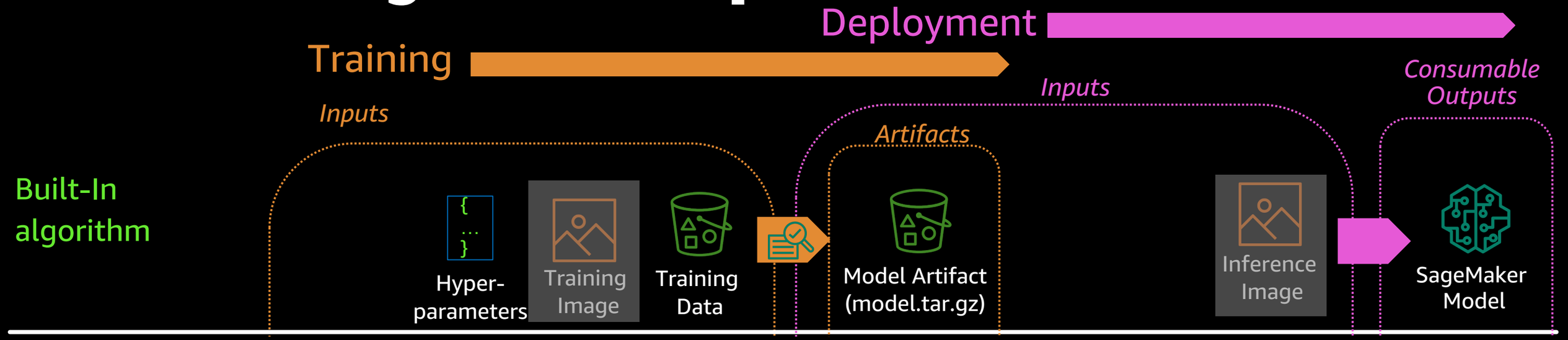
Automating Amazon SageMaker workflows



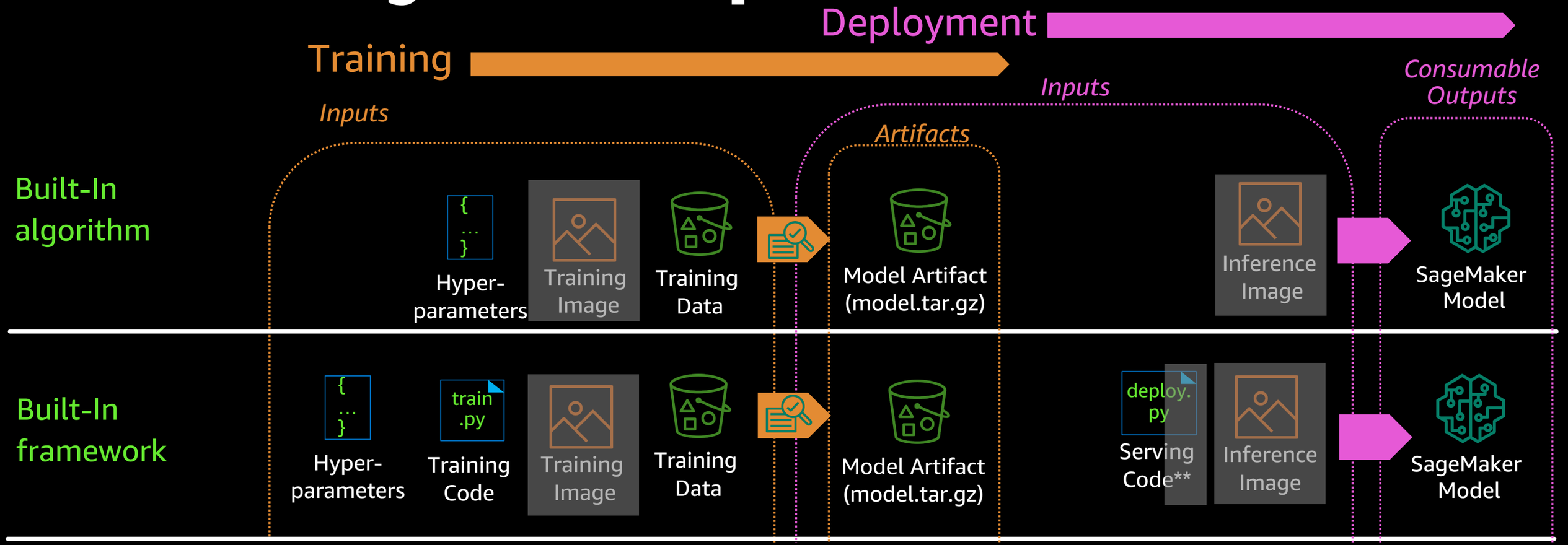
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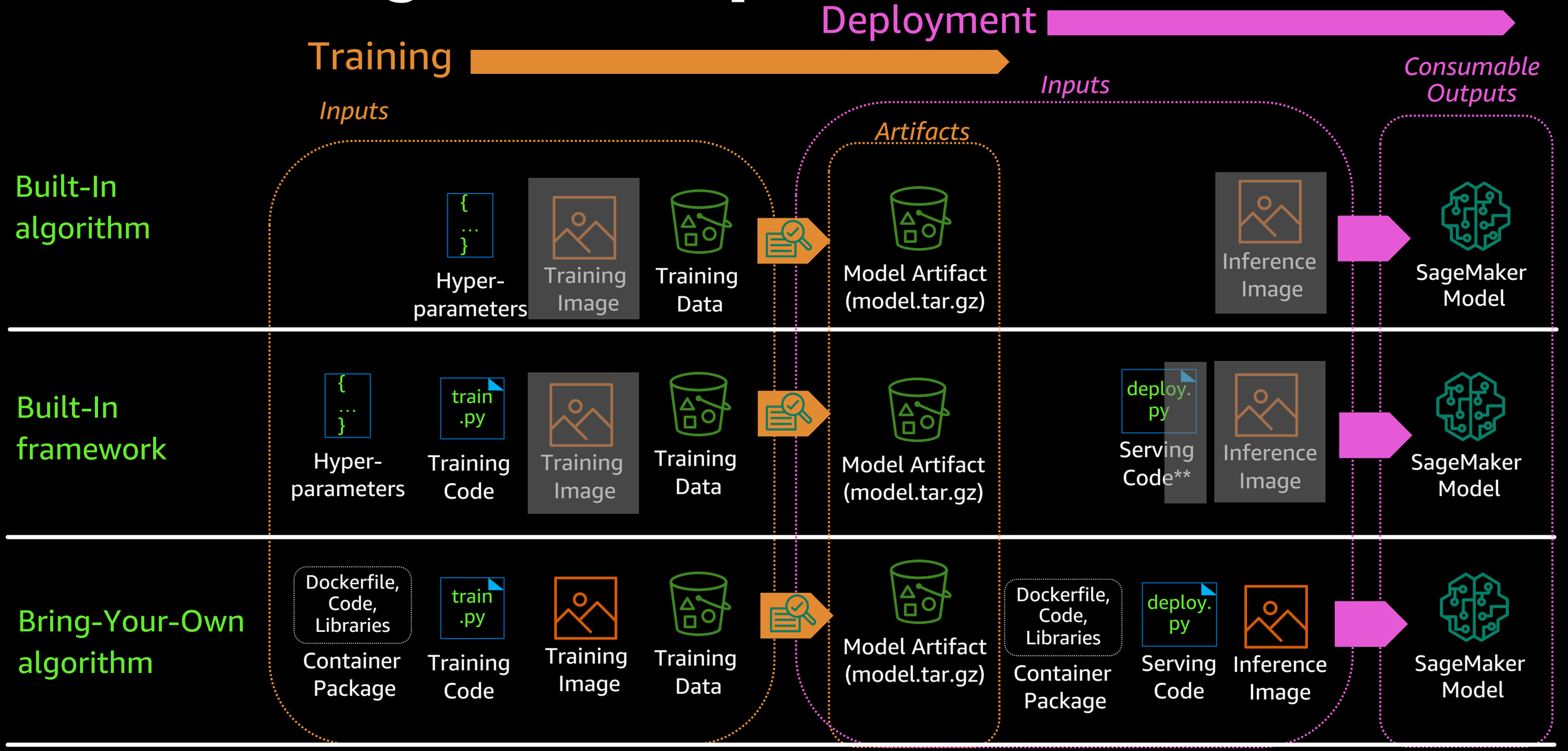
Amazon SageMaker inputs and artifacts



Amazon SageMaker inputs and artifacts



Amazon SageMaker inputs and artifacts



Creating retraining strategies

1 - Scheduled

Example:

"We know we want to train every week on Saturday at 23:00"

Amazon EventBridge
Scheduled event

2 - Event Driven

Example:

AWS Glue
Job Status

Amazon EventBridge
AWS event

3 - Metric Based

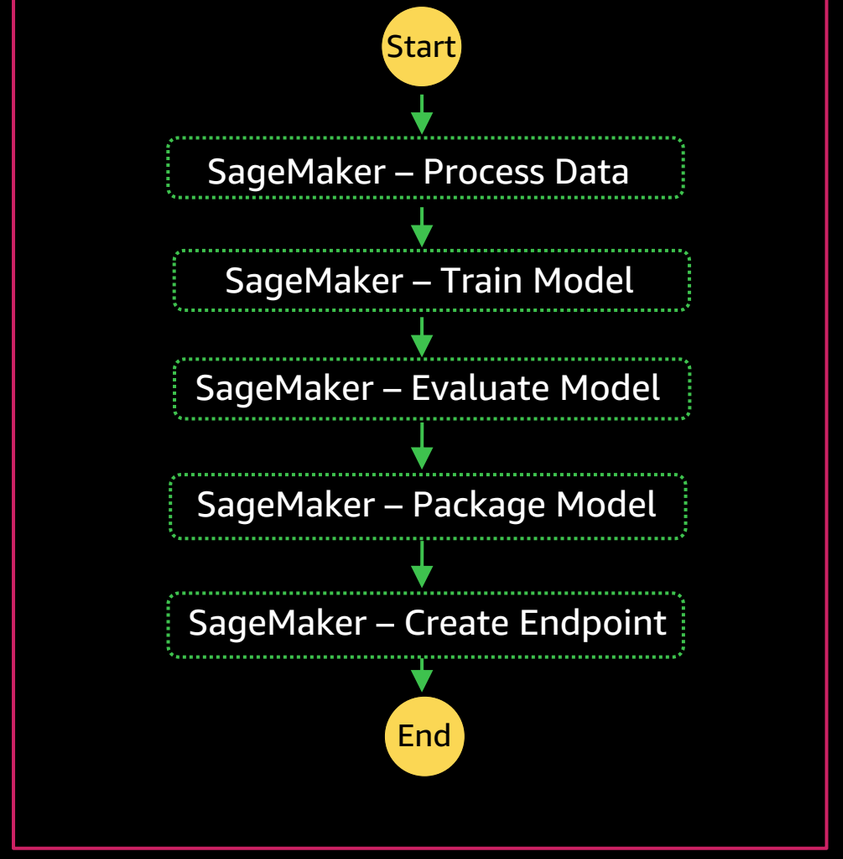
Example:

Data Drift Alert

Amazon CloudWatch
Event (event-based)

Trigger retraining workflow

AWS Step Functions workflow



Creating Amazon SageMaker workflows

THIRD-PARTY INTEGRATIONS AND OPERATORS

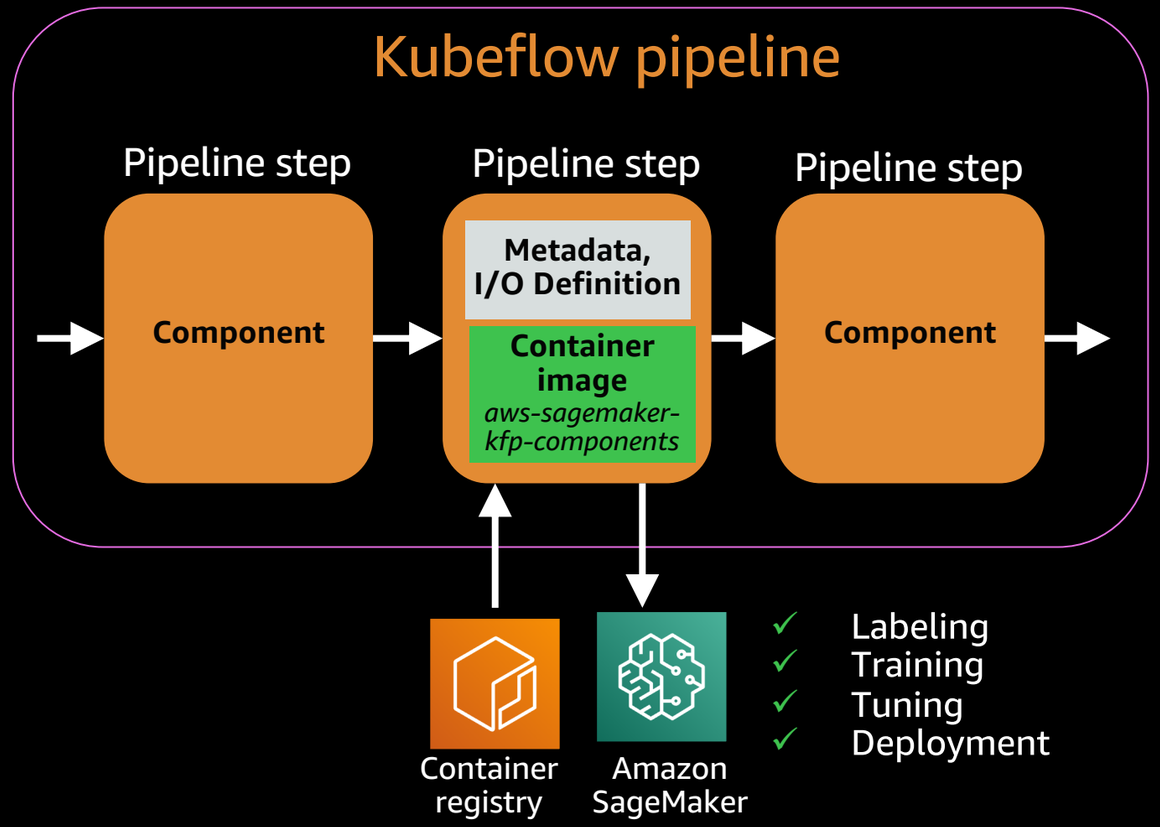
Benefits

- ✓ Utilize advanced training and deployment capabilities of Amazon SageMaker
- ✓ Minimize workflow tooling capacity footprint
- ✓ Reduce overhead of managing servers

Examples:

- ✓ Amazon SageMaker Operators for Kubernetes
- ✓ Amazon SageMaker Components for Kubeflow
- ✓ Apache AirFlow
- ✓ Many others!

Example: Amazon SageMaker Components for Kubeflow



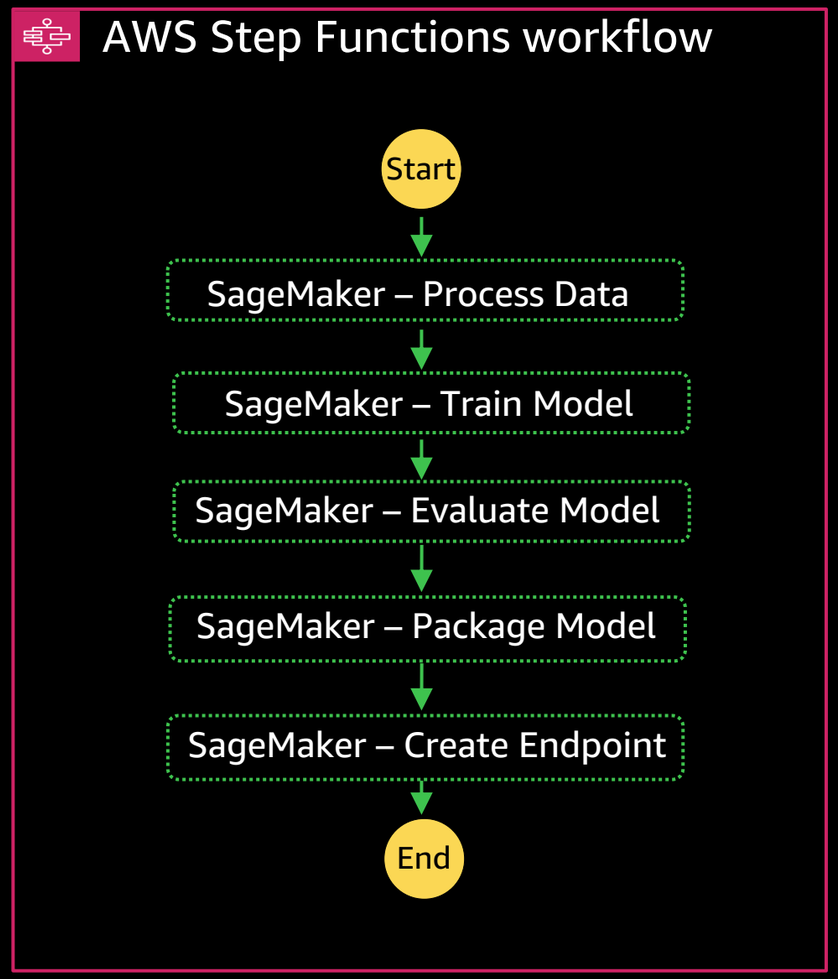
Building Amazon SageMaker CI/CD pipelines



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CI/CD pipelines for Amazon SageMaker



Let’s look at our previous simple workflow

- ✓ Source and version control?
- ✓ Quality gates?
- ✓ Multi-step release processes?
- ✓ End-to-end traceability?

CI/CD pipelines for Amazon SageMaker

ARCHITECTING YOUR CI/CD PIPELINE

Identify source code

- ✓ Training code
- ✓ Inference code
- ✓ Infrastructure-as-code
- ✓ Configuration-as-code
- ✓ Pipeline-as-code

CI/CD pipelines for Amazon SageMaker

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- ✓ Libraries / Packages
- ✓ Container images
- ✓ Data

CI/CD pipelines for Amazon SageMaker

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CI/CD pipelines for Amazon SageMaker

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Identify versioned artifact(s)	✓ Libraries / Packages	✓ Container images	
	✓ Data		
Identify quality gates	✓ Model evaluation	✓ Container image scan	✓ Manual gates
	✓ Data validation	✓ Required reporting	

CI/CD pipelines for Amazon SageMaker

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Identify deployment strategy

- ✓ Batch
- ✓ Persistent endpoint
- ✓ Deployment features
  - *Multi-Model Endpoint*
  - *Inference Pipeline*
  - *A/B Testing*
- ✓ Model consumption and integration

CI/CD pipelines for Amazon SageMaker

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Identify operational needs

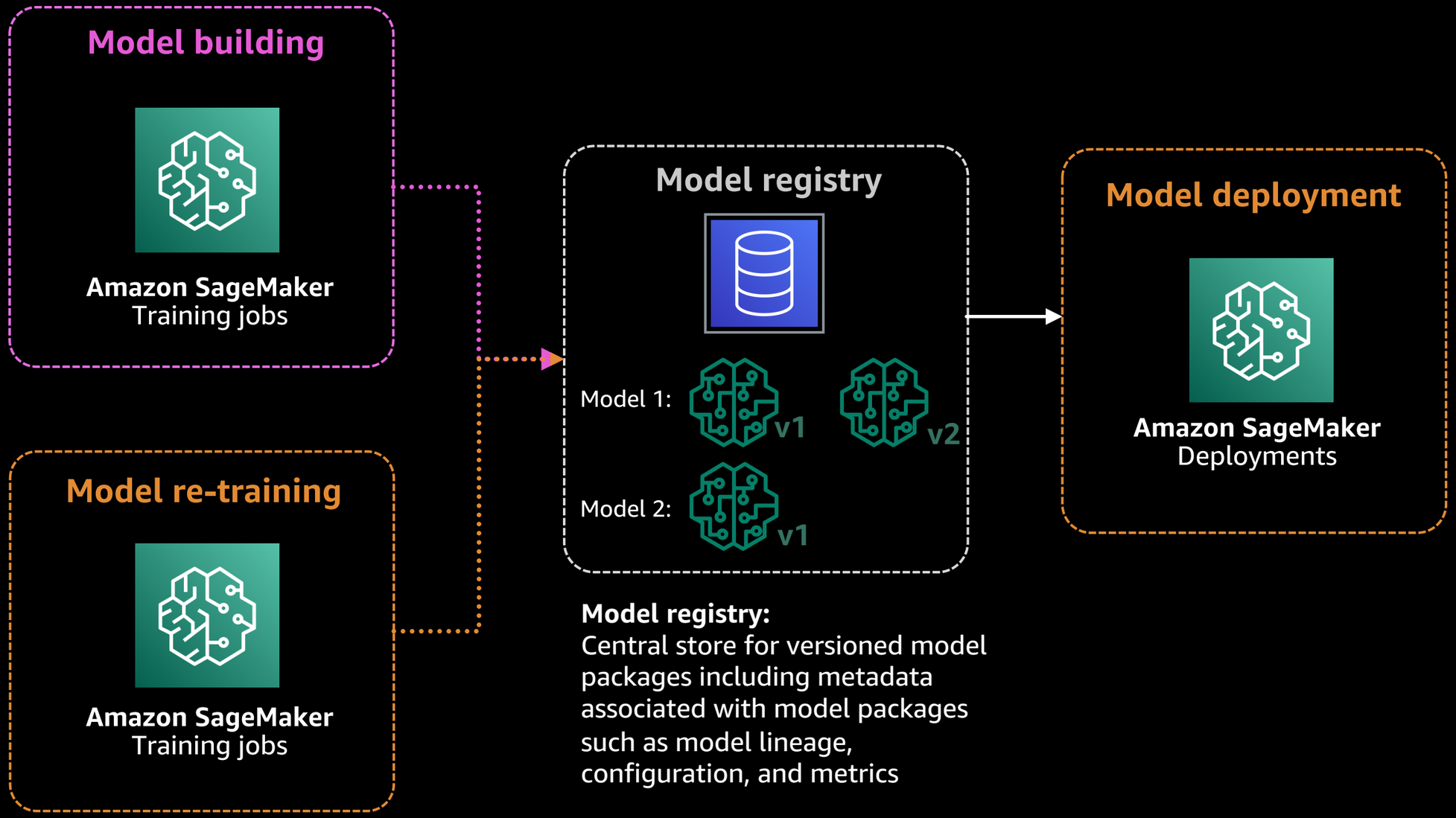
- ✓ Logging
- ✓ Monitoring and alerts
- ✓ Model monitoring (ex. Data Drift)
- ✓ Dashboards and visualization

CI/CD pipelines for Amazon SageMaker

CORE CONCEPTS

Underlying MLOps principle:
Enable innovation with protection of data and intellectual property

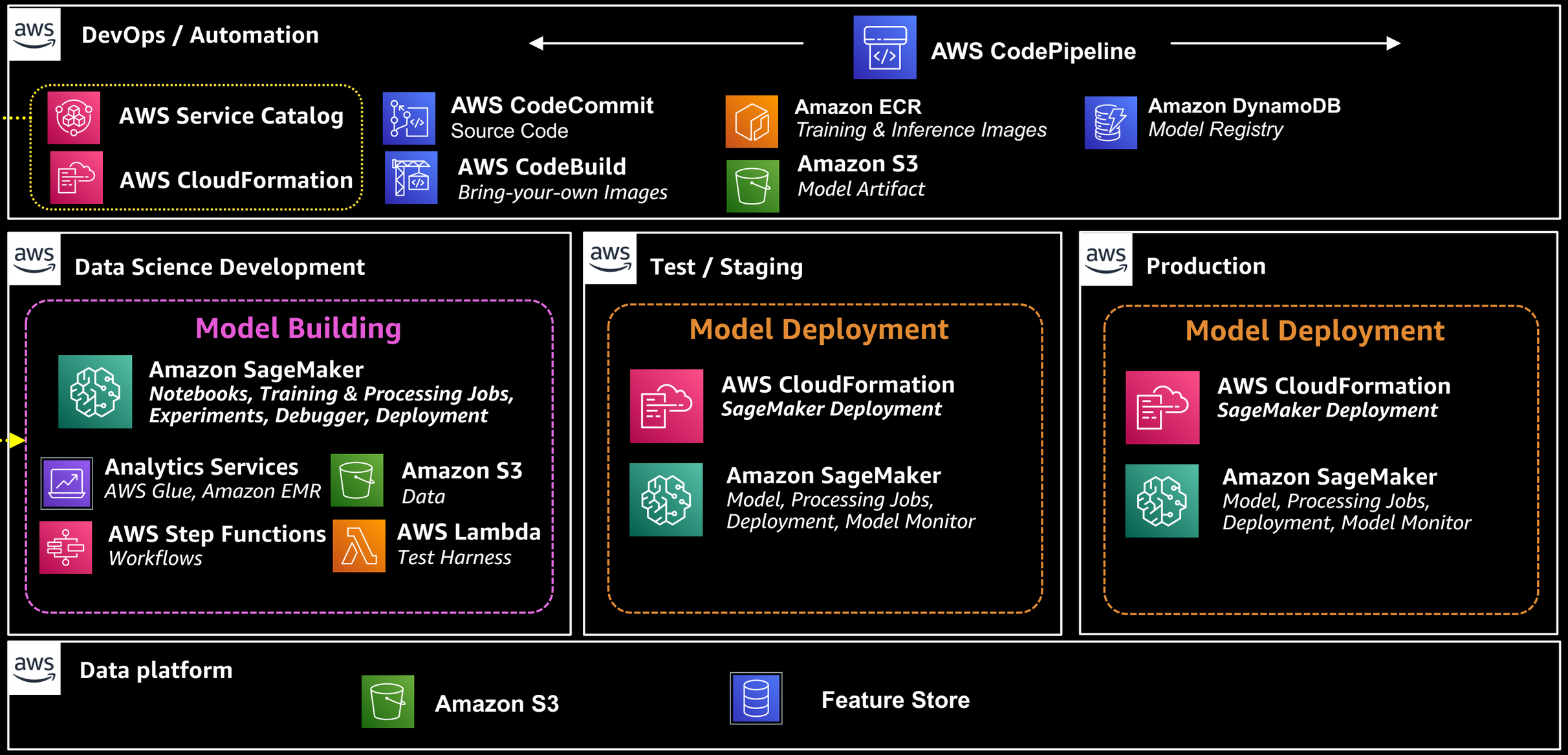
Underlying MLOps principle:
Automate retraining workflows



Model registry:
Central store for versioned model packages including metadata associated with model packages such as model lineage, configuration, and metrics

CI/CD pipelines for Amazon SageMaker

MULTI-ACCOUNT : CONCEPTUAL EXAMPLE



CI/CD pipelines for Amazon SageMaker

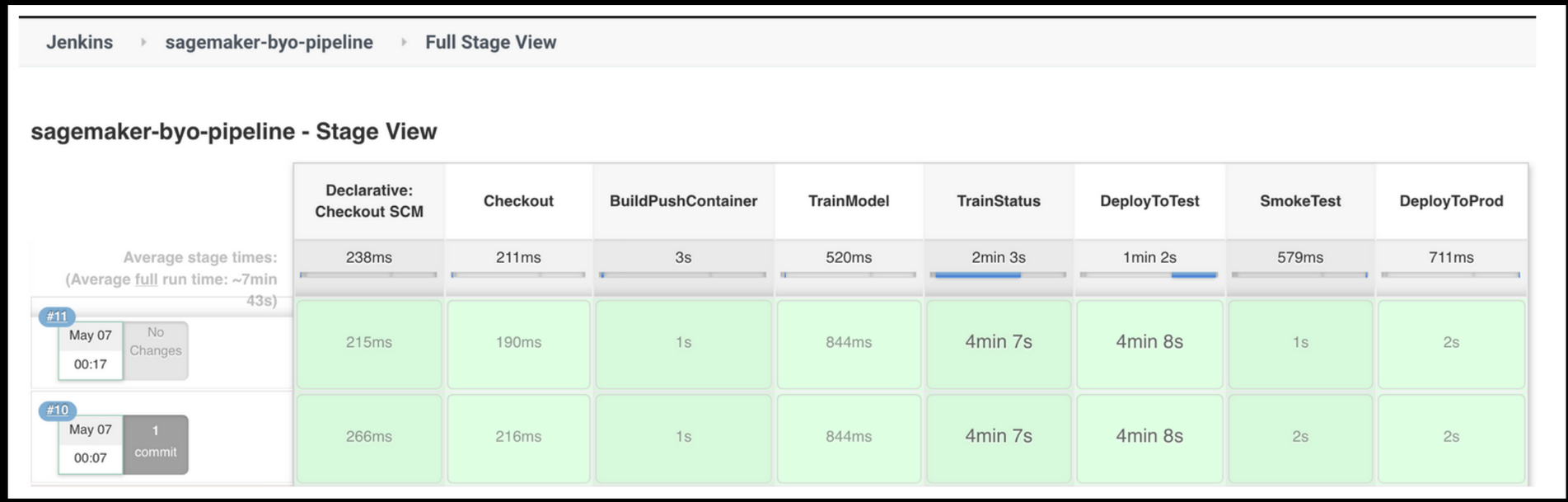
THIRD-PARTY TOOLING

SDK

CLI

Take advantage of the AWS SDK, Amazon SageMaker SDK, or CLI to incorporate SageMaker pipeline steps into your favorite CI/CD tooling

Example:



Implement MLOps practices with SageMaker

SUMMARY AND RESOURCES

Foundational knowledge

- ❑ **AWS Well-Architected framework and lenses**
  https://aws.amazon.com/architecture/well-architected

- ❑ **Whitepapers (DevOps, machine learning)**
  https://aws.amazon.com/whitepapers

Hands-on

- ❑ **MLOps labs, workshops, and templates**
  https://github.com/aws-samples/mlops-amazon-sagemaker-devops-with-ml

Thank you!

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