



# Présentation Azure ML

Vendredi 13 mars 2020



# Vos interlocuteurs

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# Machine Learning on Azure

## Domain specific pretrained models

To simplify solution development



Vision



Speech



Language



Search

## Familiar Data Science tools

To simplify model development



Visual Studio Code



Azure Notebooks



Jupyter



Command line

## Popular frameworks

To build advanced deep learning solutions



PyTorch



TensorFlow



Scikit-Learn



ONNX

## Productive services

To empower data science and development teams



Azure  
Databricks



Azure Machine  
Learning



Machine  
Learning VMs

## Powerful infrastructure

To accelerate deep learning



CPU



GPU



FPGA



From the Intelligent Cloud to the Intelligent Edge

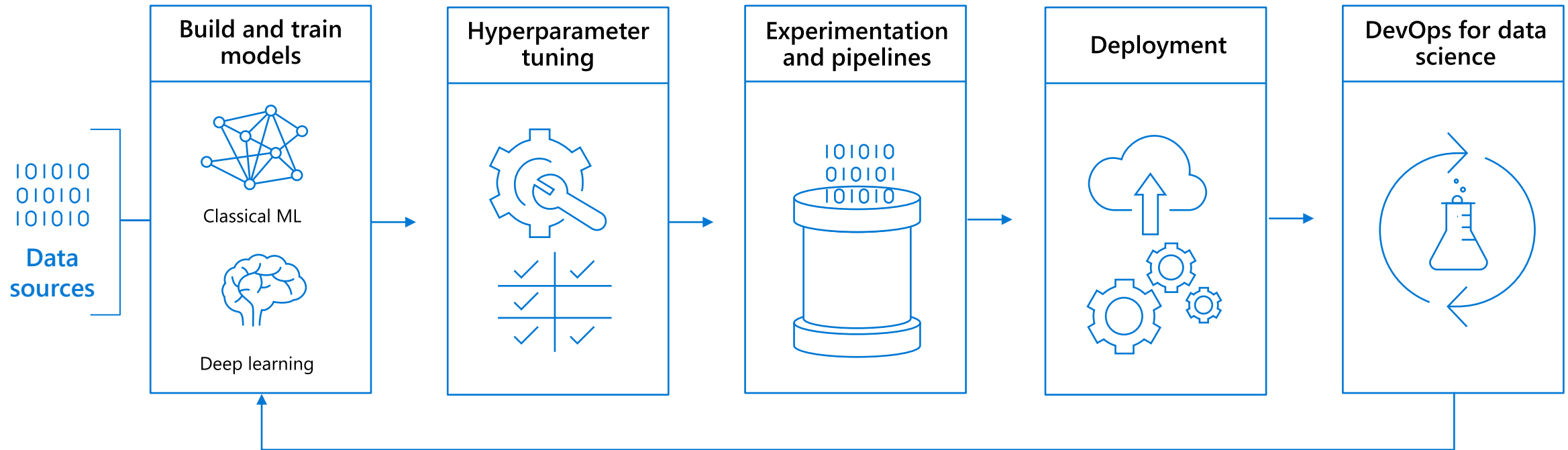




# Azure Machine Learning

<https://azure.microsoft.com/fr-fr/services/machine-learning/>

# Building blocks for a Data Science Project



# Azure Machine Learning

Set of Azure Cloud  
Services



Python  
& R SDK, CLI, UX

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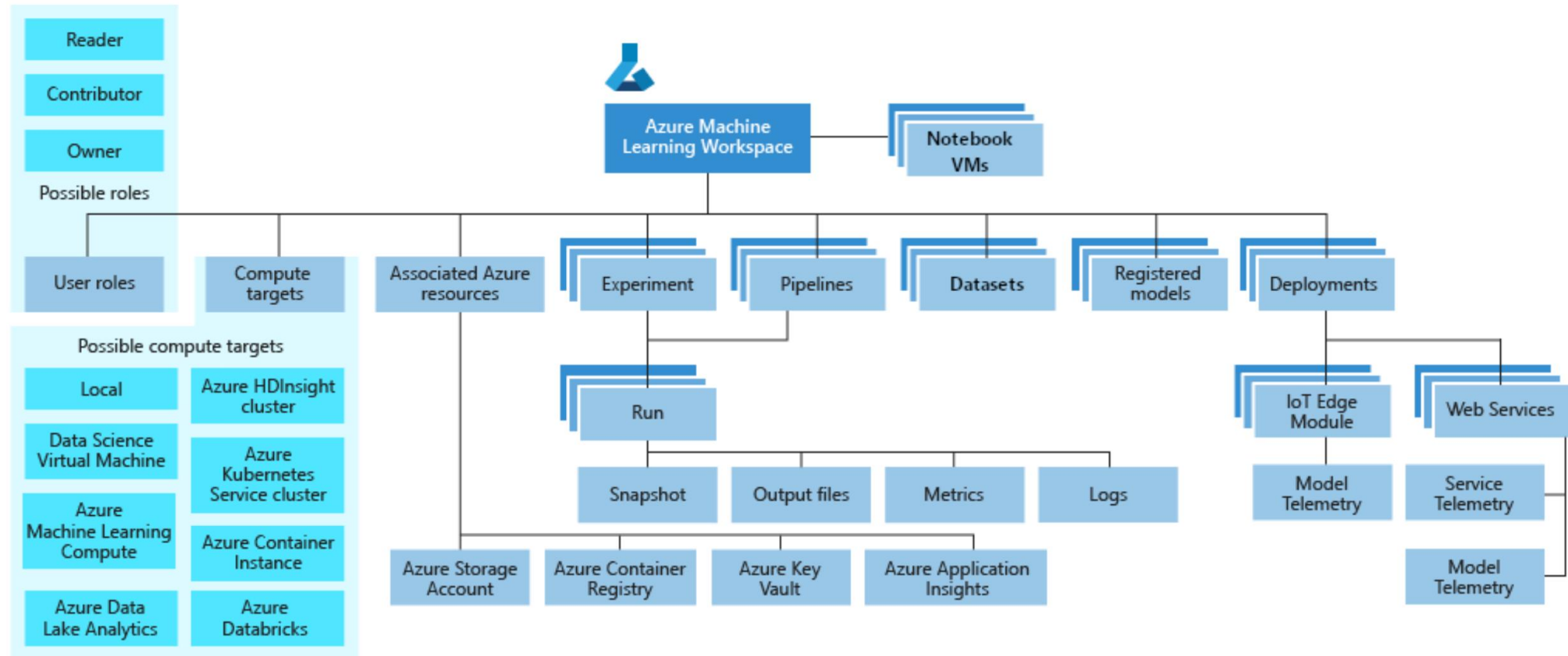
That enables you to:

- ✓ Prepare Data
- ✓ Build Models
- ✓ Train Models

- ✓ Manage Models
- ✓ Track Experiments
- ✓ Deploy Models

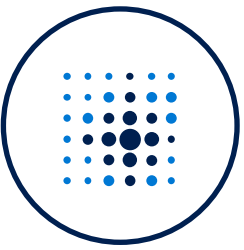
Composants Azure ML

# Azure Machine Learning components





# Azure ML Studio



# Azure ML Studio

For all skill levels  
studio web experience

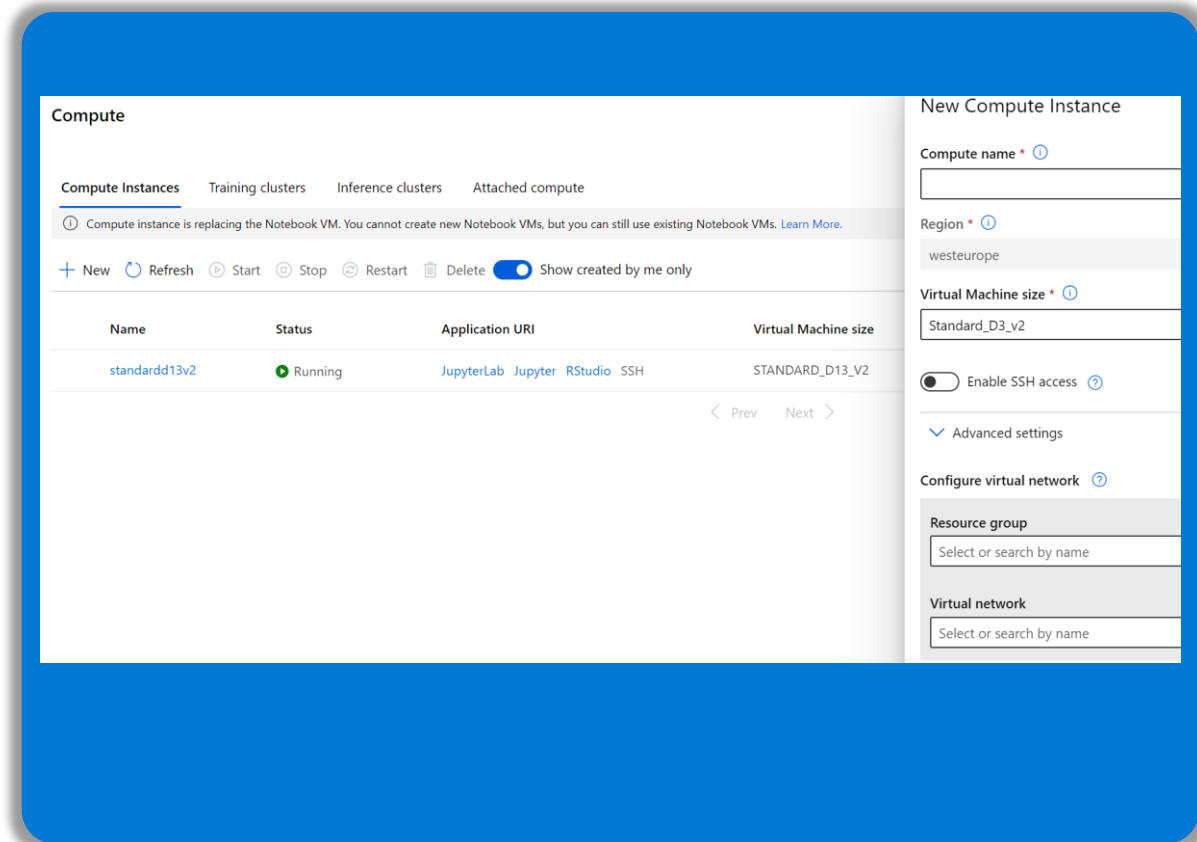
The screenshot displays the Azure ML Studio web interface. On the left is a navigation sidebar with a menu icon at the top, followed by 'New', 'Home' (selected), and sections for 'Author' (Notebooks, Automated ML, Designer), 'Assets' (Datasets, Experiments, Pipelines, Models, Endpoints), and 'Manage' (Compute, Datastores, Data Labeling). The main content area has a breadcrumb 'workshop-aml-2020 > Home' and a 'Welcome to the studio!' message. Below this are four cards: 'Create new' with a plus icon, 'Notebooks' with a calendar icon and description 'Code with Python SDK and run sample experiments.', 'Automated ML' with a lightning bolt icon and description 'Automatically train and tune a model using a target metric.', and 'Designer' with a flowchart icon and description 'Drag-and-drop interface from prepping data to deploying models.' Each card has a 'Start now' button. At the bottom, the 'My recent resources' section contains a table with two parts: 'Runs' and 'Compute'.

Runs				Compute
Run number	Experiment	Updated time	Status	Name
2	<a href="#">workshop5-amlcompute</a>	Feb 18, 2020 2:56 PM	Completed	<a href="#">AKSML</a>

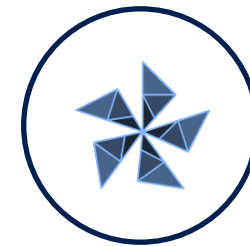
# Notebooks

# Machine Learning notebooks

- Fully managed cloud-based solution for data scientists to get started with ML machine learning
- Deeply integrated with Azure ML workspaces and datastores
- First-class experience for model authoring through integrated notebooks using Azure ML Python and R SDK.
- Management and enterprise readiness capabilities for IT administrators.

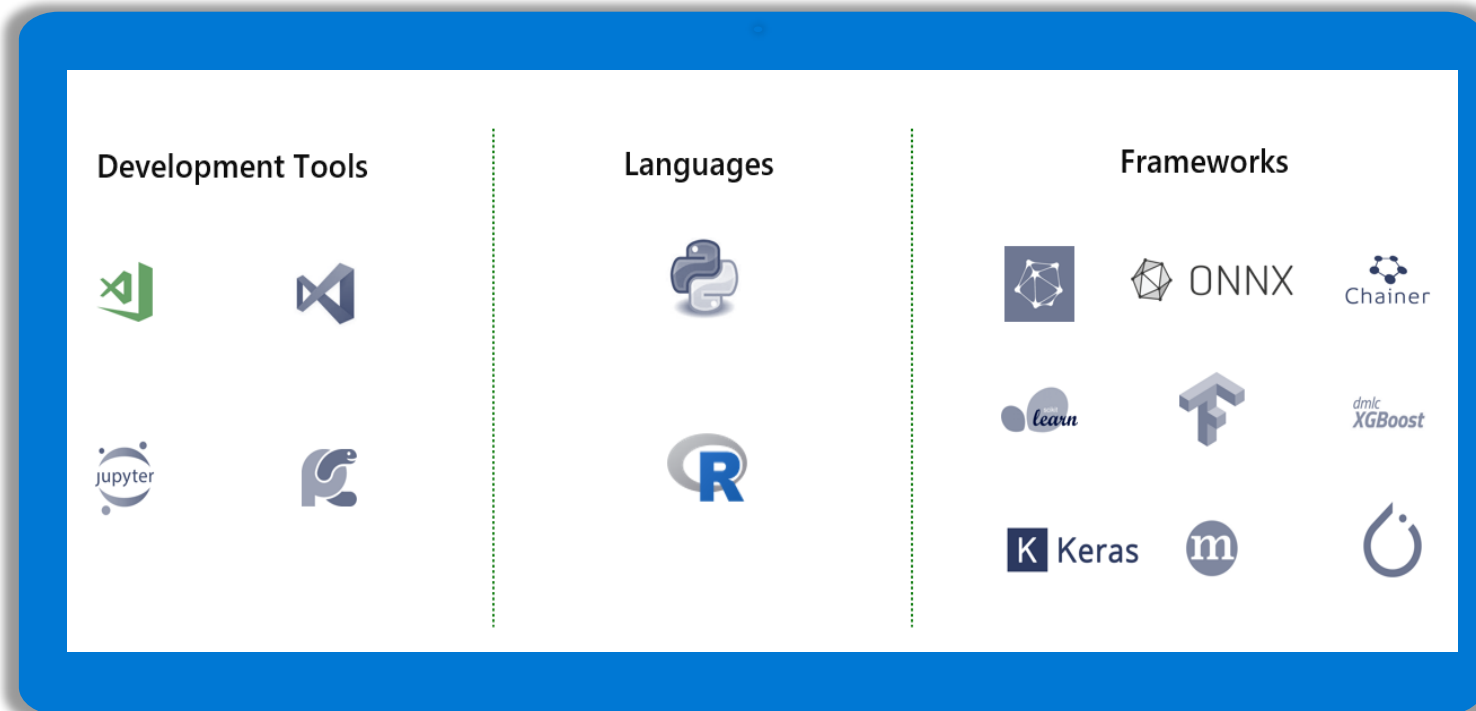


# Platform



# Azure Machine Learning

Open and interoperable platform



# Powerful infrastructure

Accelerate deep learning



## CPUs

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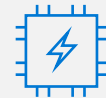
General purpose  
machine learning  
D, F, L, M, H Series



## GPUs

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Deep learning  
N Series



## FPGAs

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Specialized hardware  
accelerated deep learning  
AML hardware accelerated  
models (Project Brainwave)

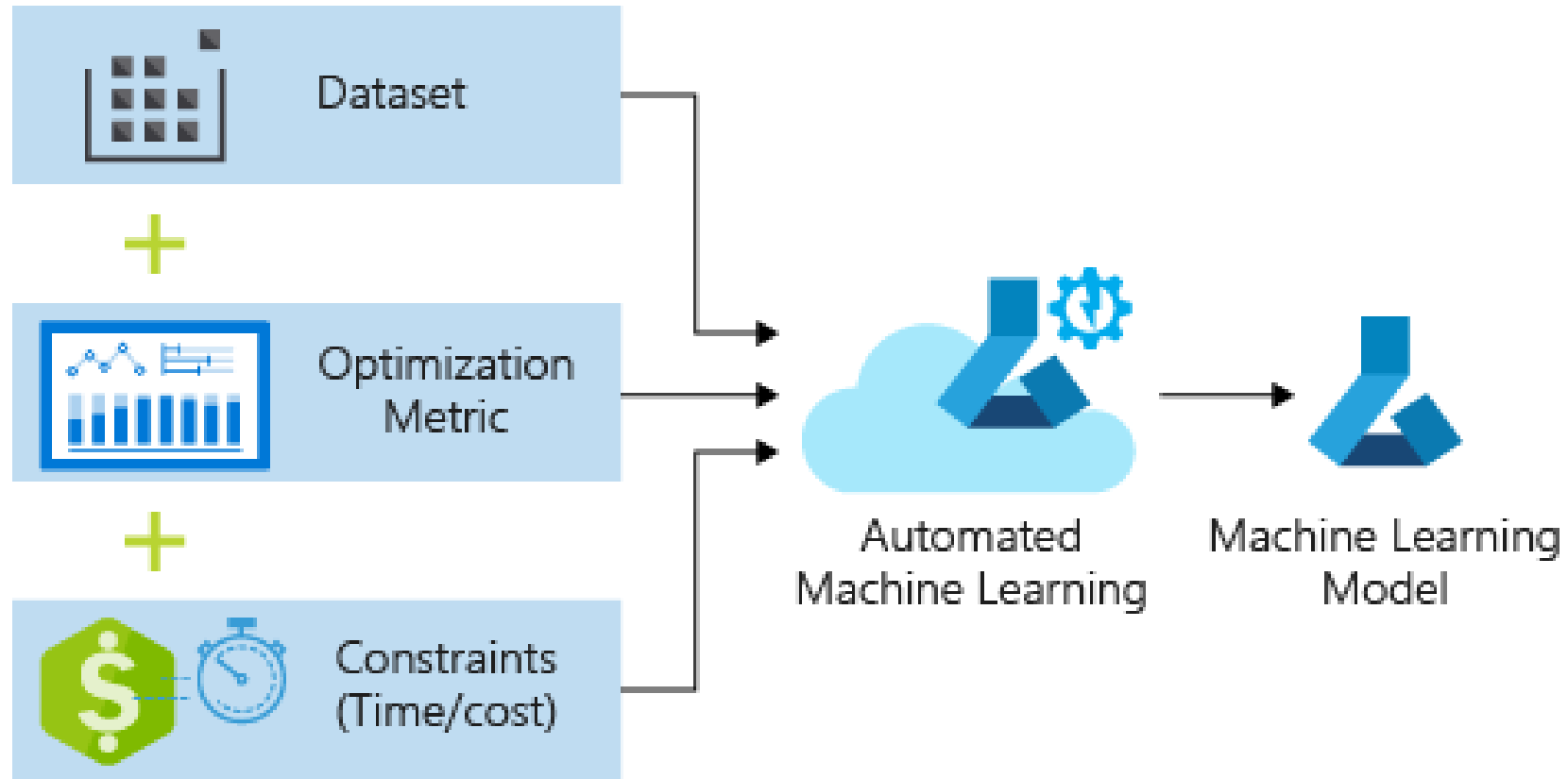
← Optimized for flexibility

→ Optimized for performance

# AutoML



# Automated ML



# Azure Machine Learning accelerates model development

with automated machine learning

Input

Intelligently test multiple models in parallel

101010  
010101  
101010

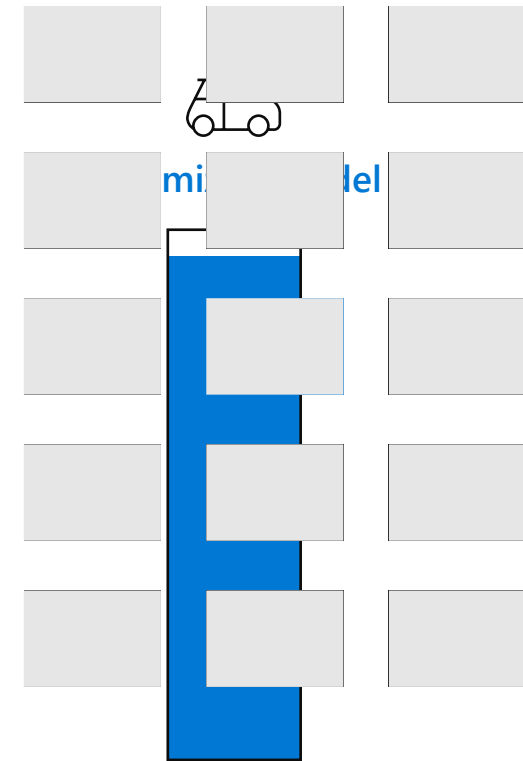
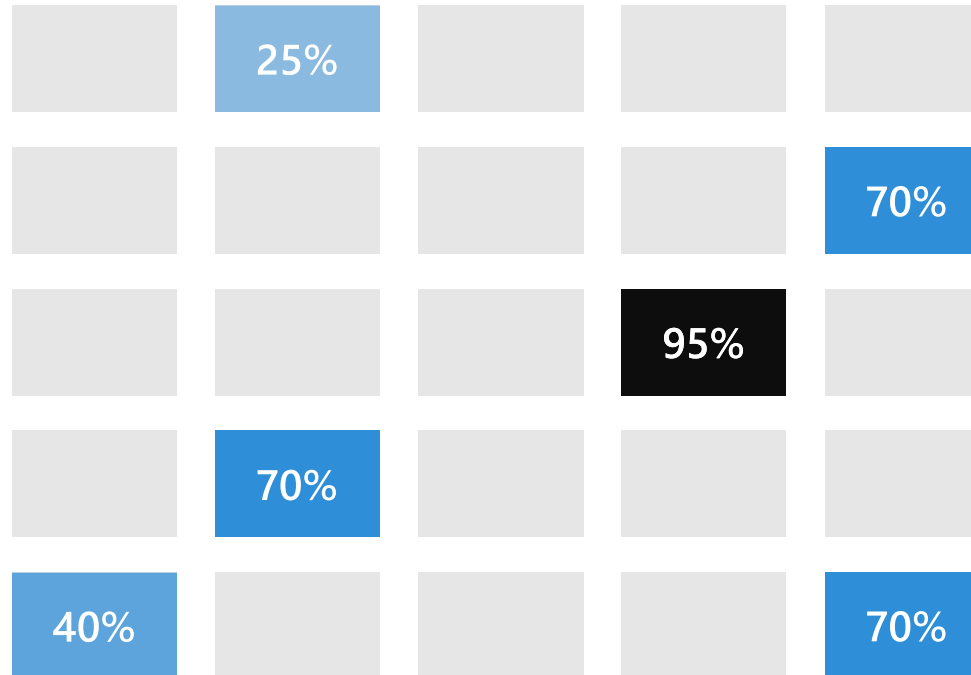
Enter data



Define goals



Apply constraints



# Automated ML

Automatically build and deploy predictive models using the no-code UI or through a code-first notebooks experience.

Increase productivity with easy data exploration and profiling and with intelligent feature engineering.

Easily create accurate models customized to your data and refined by a wide array of algorithms and hyperparameters.

Build responsible AI solutions with model interpretability, and fine-tune your models to improve accuracy.

The screenshot displays a user interface for creating a new Automated ML run. On the left, a vertical progress bar indicates the steps: 'Select dataset' (checked), 'Configure run' (checked), and 'Task type and settings' (active). The main area is titled 'Select task type' and includes a descriptive sentence: 'Select the machine learning task type for the experiment. Additional settings are available to fine tune the experiment if needed.' Below this, three task options are listed: 'Classification' (selected with a green checkmark), 'Regression', and 'Time series forecasting'. The 'Classification' option includes a sub-description: 'To predict one of several categories in the target column. yes/no, blue, red, green.' There is also an unchecked checkbox for 'Enable deep learning (preview)' with a help icon. At the bottom, there are two links: 'View additional configuration settings' and 'View featurization settings'.

Create a new Automated ML run

☒ Select dataset

☒ Configure run

☐ Task type and settings

**Select task type**

Select the machine learning task type for the experiment. Additional settings are available to fine tune the experiment if needed.

☒ **Classification**  
To predict one of several categories in the target column. yes/no, blue, red, green.

☐ Enable deep learning (preview) ⓘ

☐ **Regression**  
To predict continuous numeric values

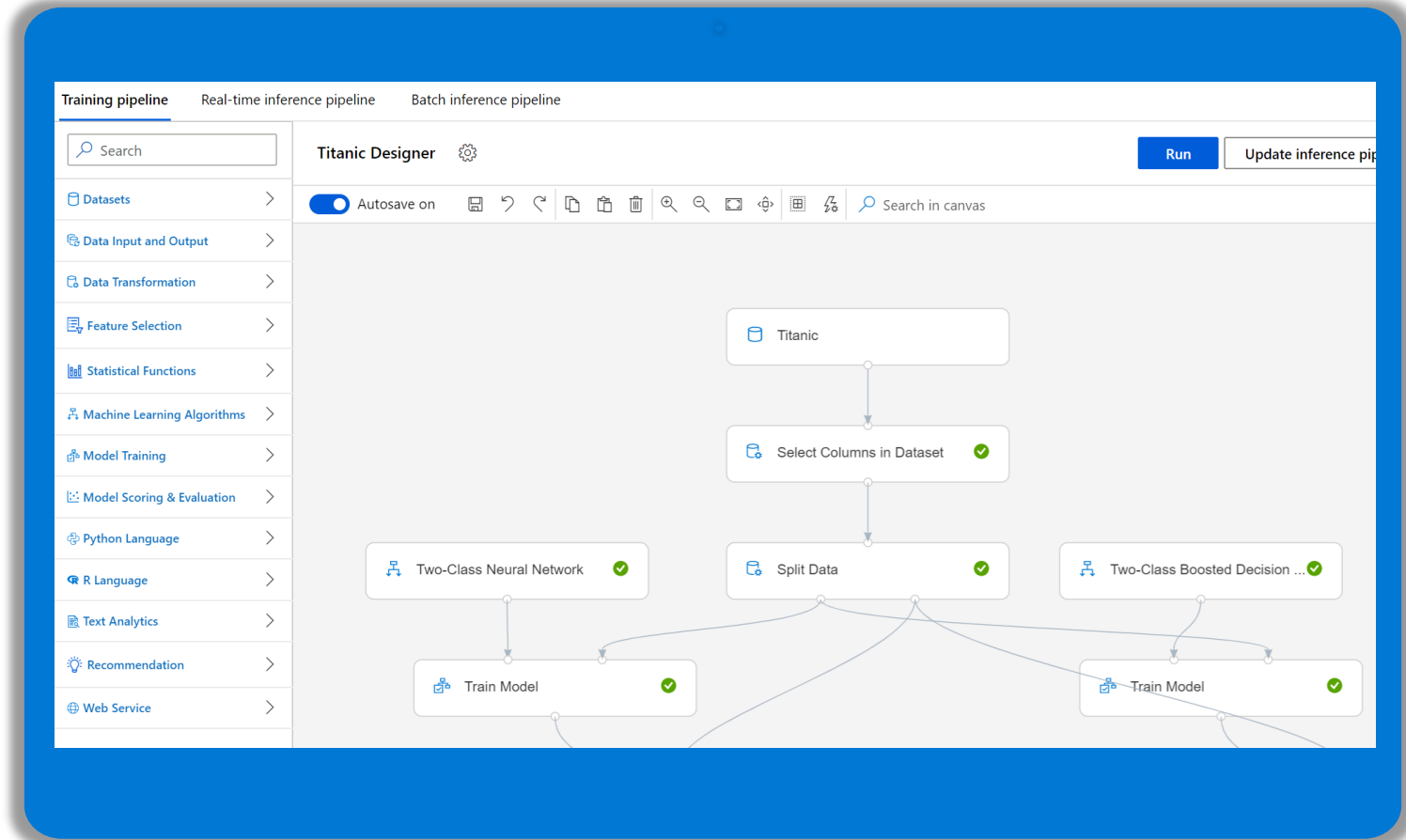
☐ **Time series forecasting**  
To predict values based on time

[⚙️ View additional configuration settings](#) [🔍 View featurization settings](#)

# Designer

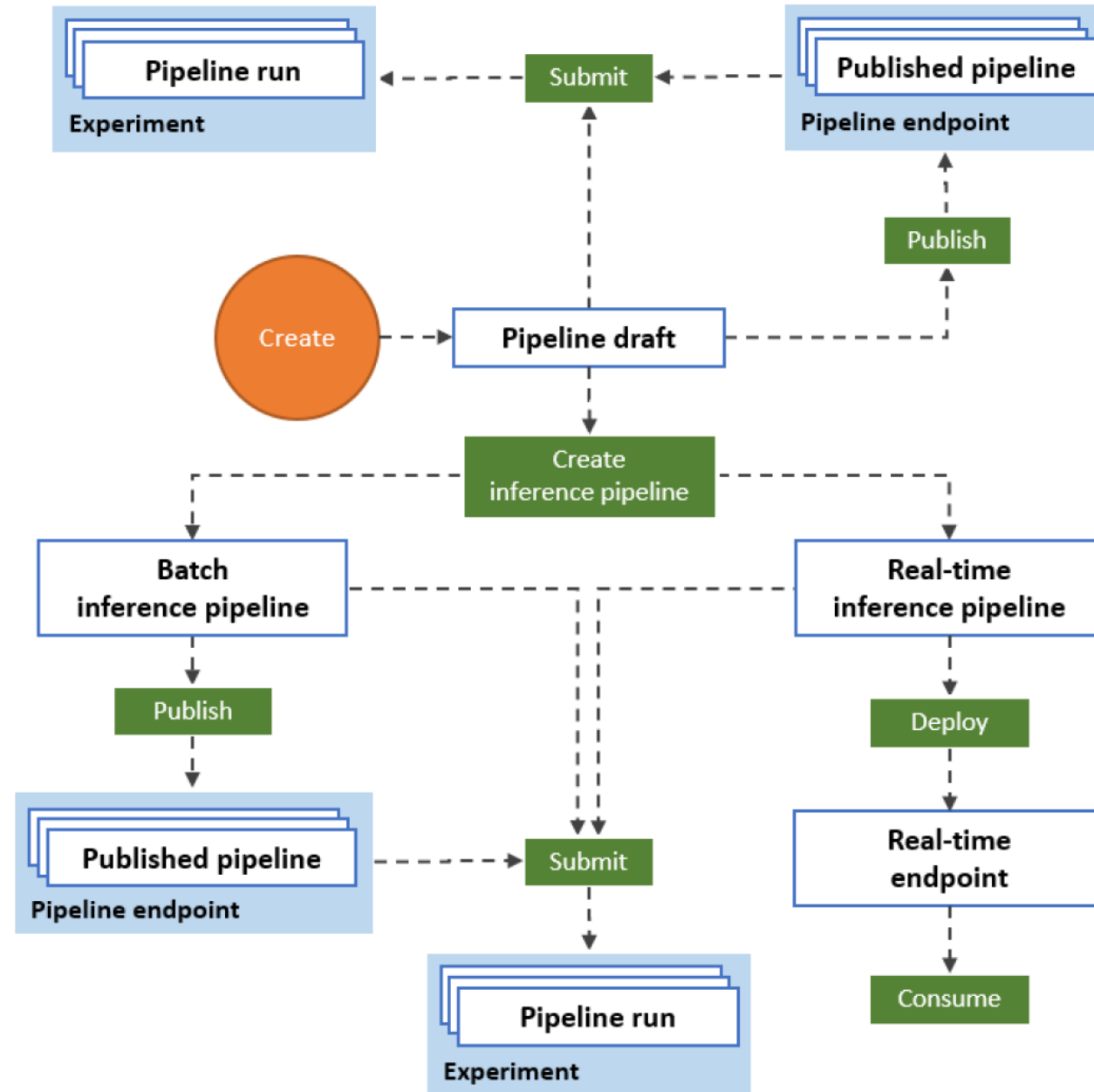
# Designer

- Drag-n-drop workflow capability
- Simplify the process of building, testing, and operating machine learning models
- Create new pipelines



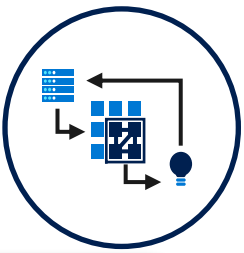
# Pipelines

# Pipelines



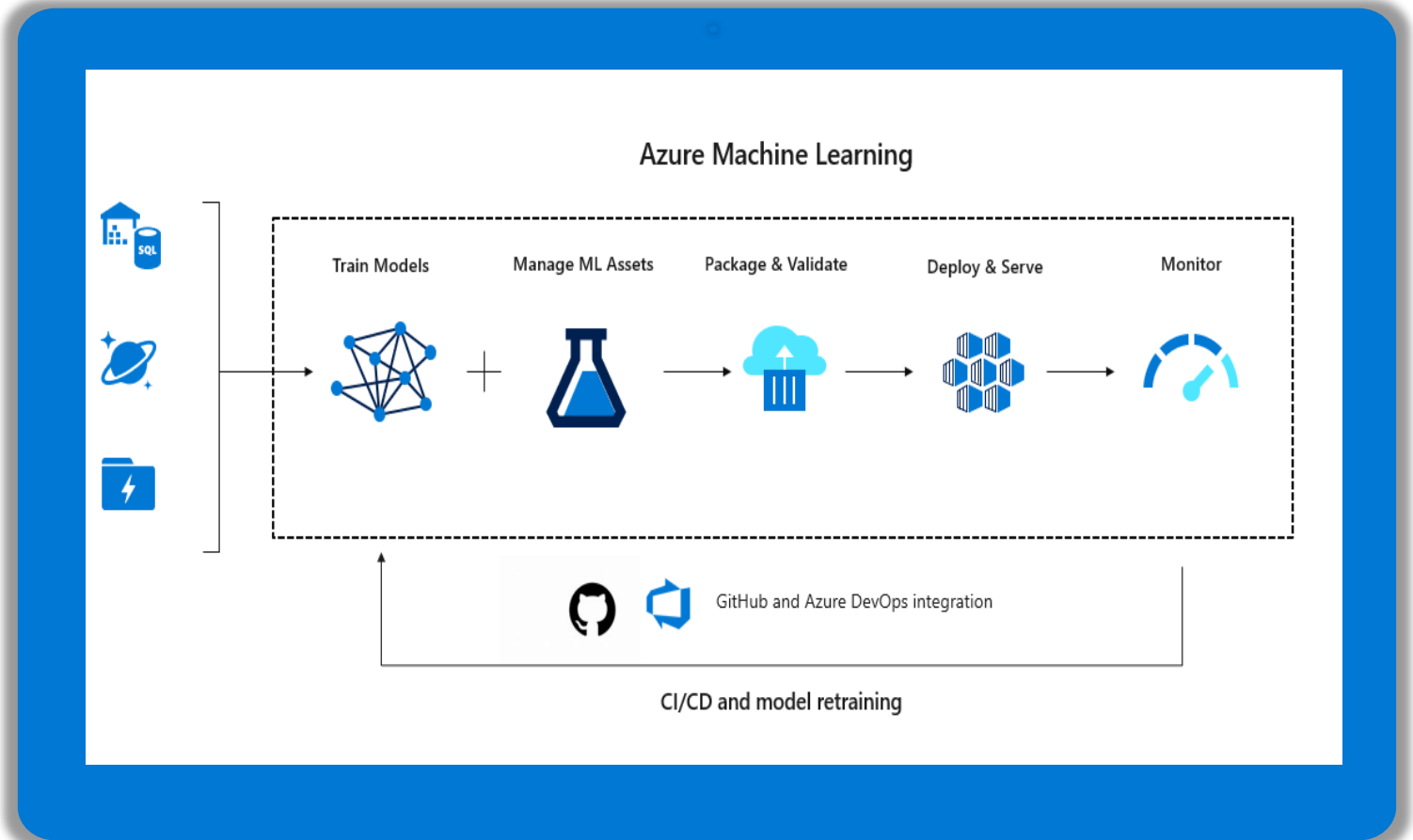
# MLOps





# Azure Machine Learning

Industry leading MLOps



# DevOps



Code reproducibility



Code testing



App deployment

# MLOps



Model reproducibility



Model validation



Model deployment

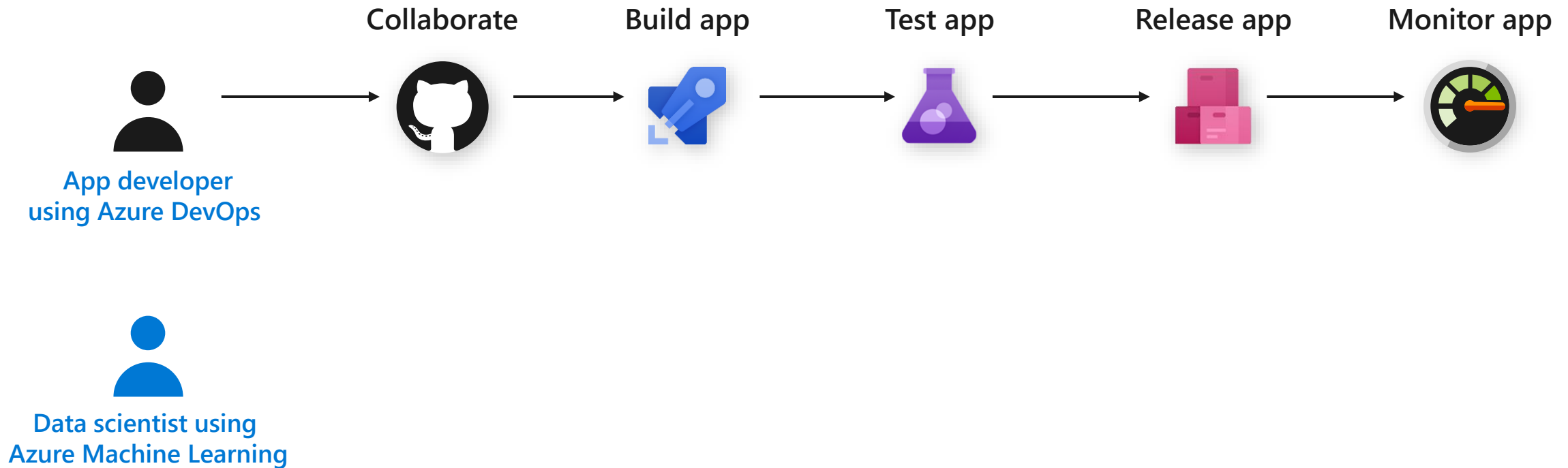


Model retraining

# MLOps

- **Create reproducible ML pipelines.**  
Pipelines allow you to define repeatable and reusable steps for your data preparation, training, and scoring processes.
- **Register, package, and deploy models** from anywhere and track associated metadata required to use the model.
- **Capture the governance** data required for capturing the end-to-end ML lifecycle, including who is publishing models, why changes are being made, and when models were deployed or used in production.
- **Notify and alert on events in the ML lifecycle** such as experiment completion, model registration, model deployment, and data drift detection.
- **Monitor ML applications** for operational and ML-related issues.  
Compare model inputs between training and inference, explore model-specific metrics, and provide monitoring and alerts on your ML infrastructure.
- **Automate the end-to-end ML lifecycle with Azure Machine Learning and Azure DevOps** to frequently update models, test new models, and continuously roll out new ML models alongside your other applications and services.

# MLOps with Azure Machine Learning



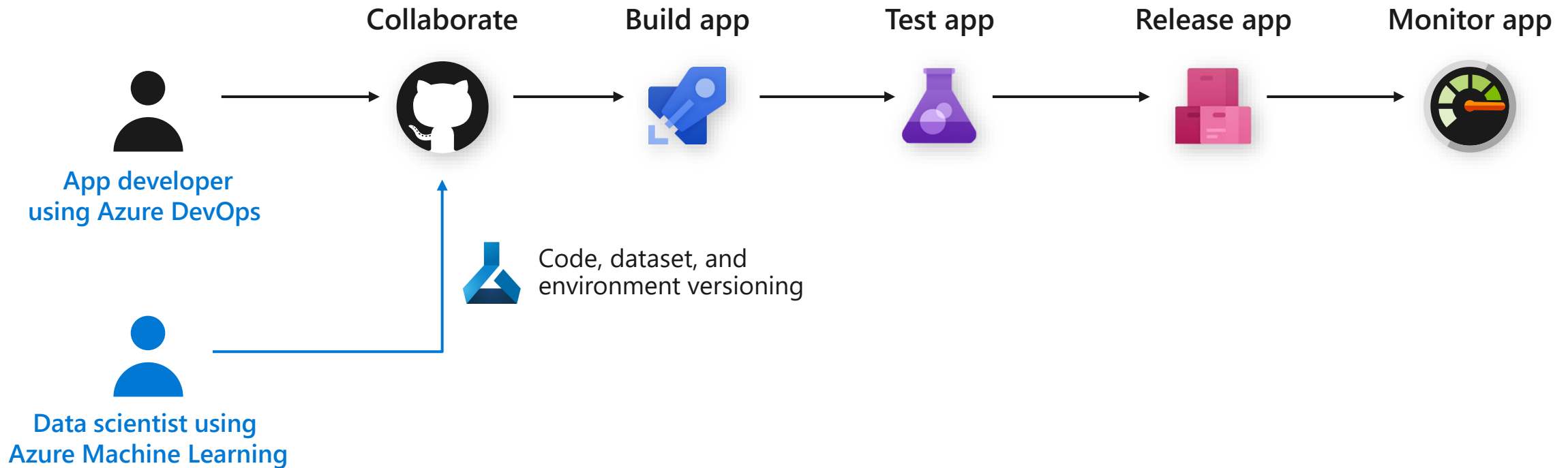
☐ Model reproducibility

☐ Model validation

☐ Model deployment

☐ Model retraining

# MLOps with Azure Machine Learning



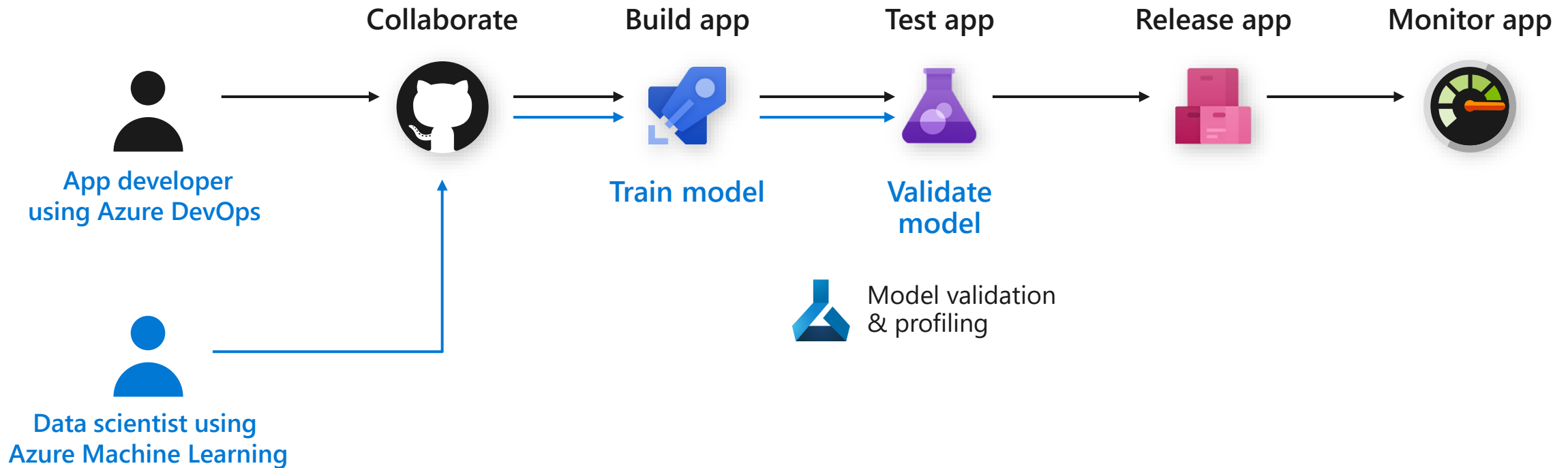
☒ Model reproducibility

☐ Model validation

☐ Model deployment

☐ Model retraining

# MLOps with Azure Machine Learning



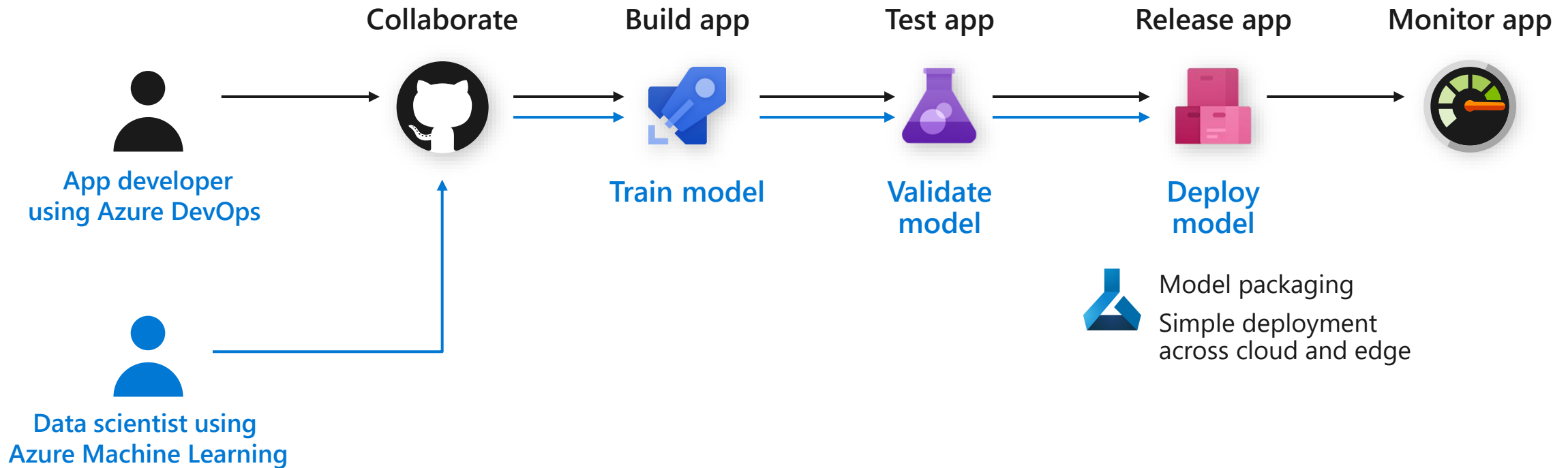
☒ Model reproducibility

☒ Model validation

☐ Model deployment

☐ Model retraining

# MLOps with Azure Machine Learning



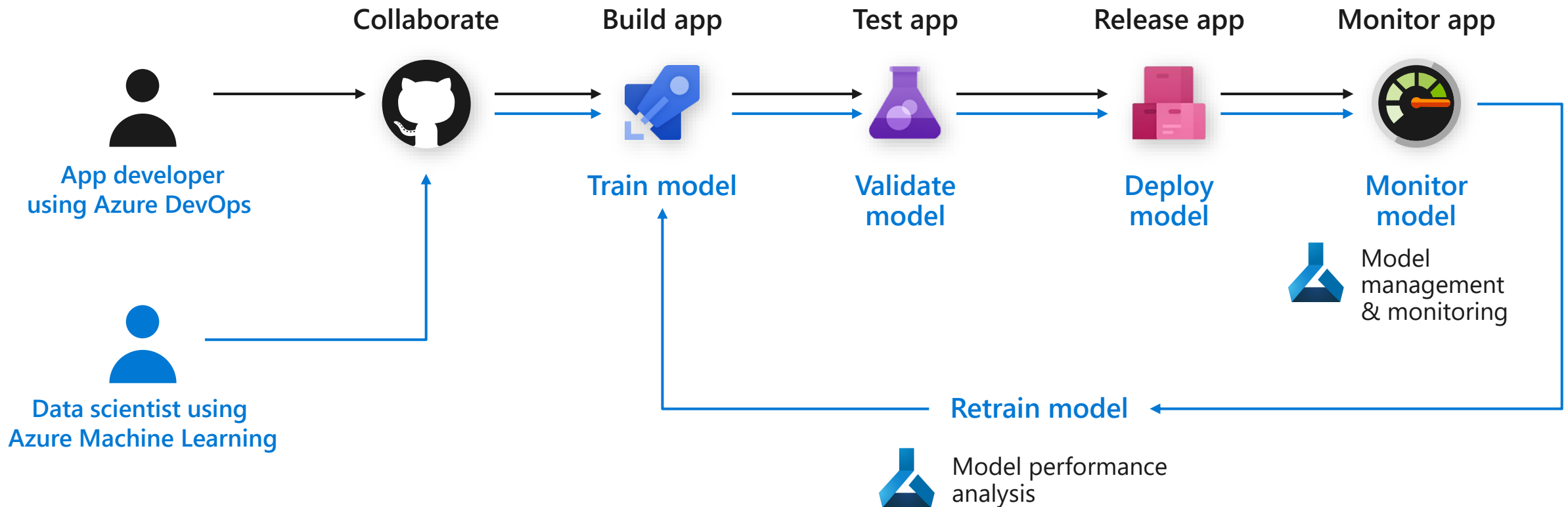
☒ Model reproducibility

☒ Model validation

☒ Model deployment

☐ Model retraining

# MLOps with Azure Machine Learning



☑ Model reproducibility

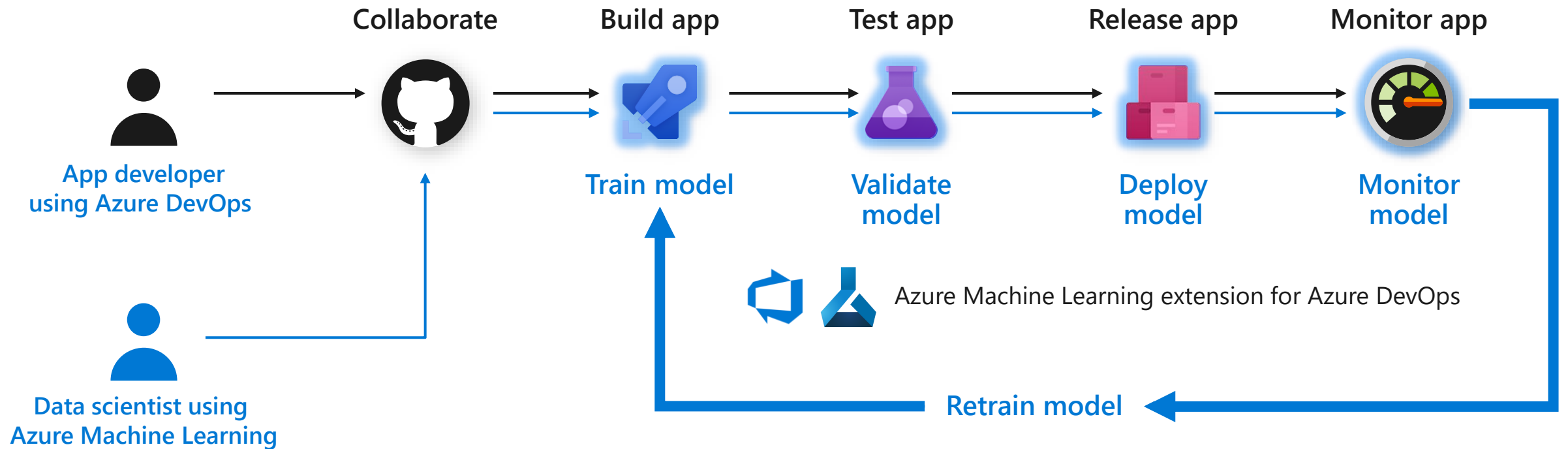
☑ Model validation

☑ Model deployment

☑ Model retraining



# MLOps with Azure Machine Learning



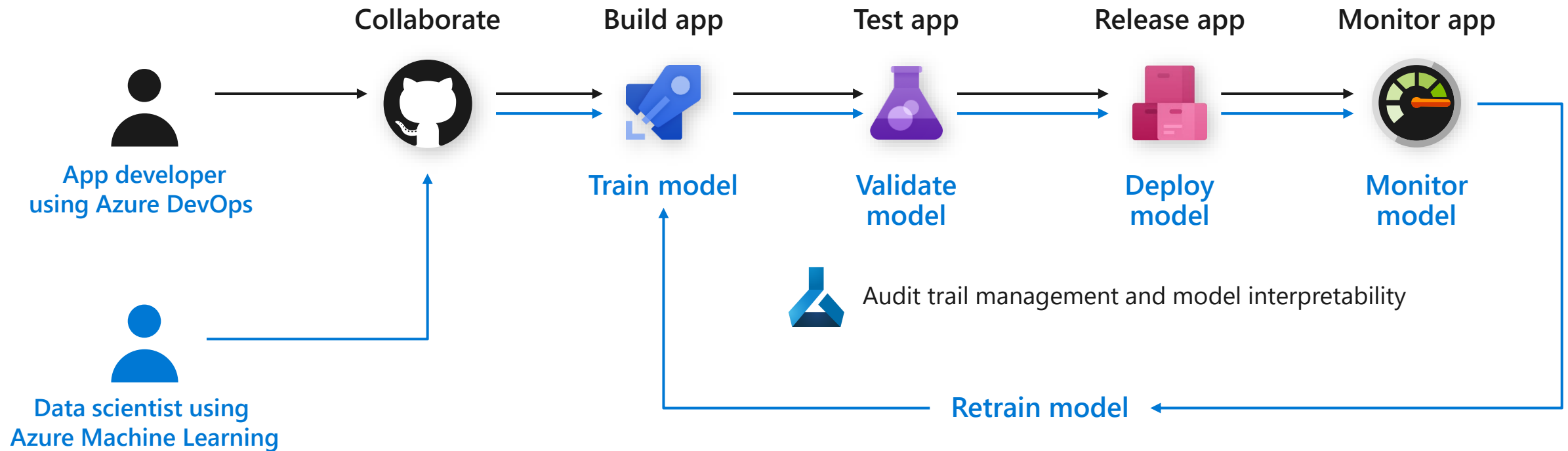
✓ Model reproducibility

✓ Model validation

✓ Model deployment

✓ Model retraining

# MLOps with Azure Machine Learning

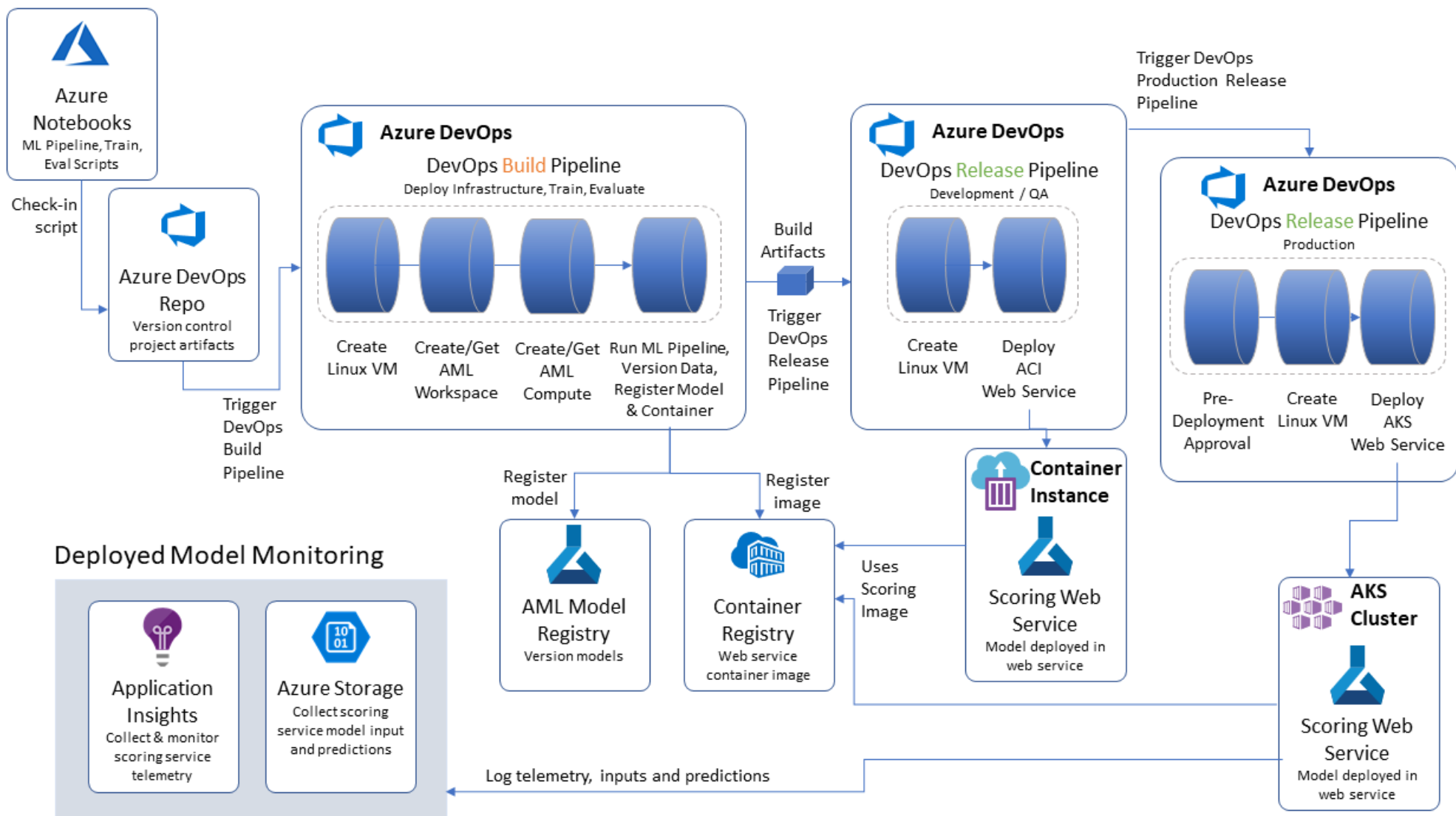


✓ Model reproducibility

✓ Model validation

✓ Model deployment

✓ Model retraining



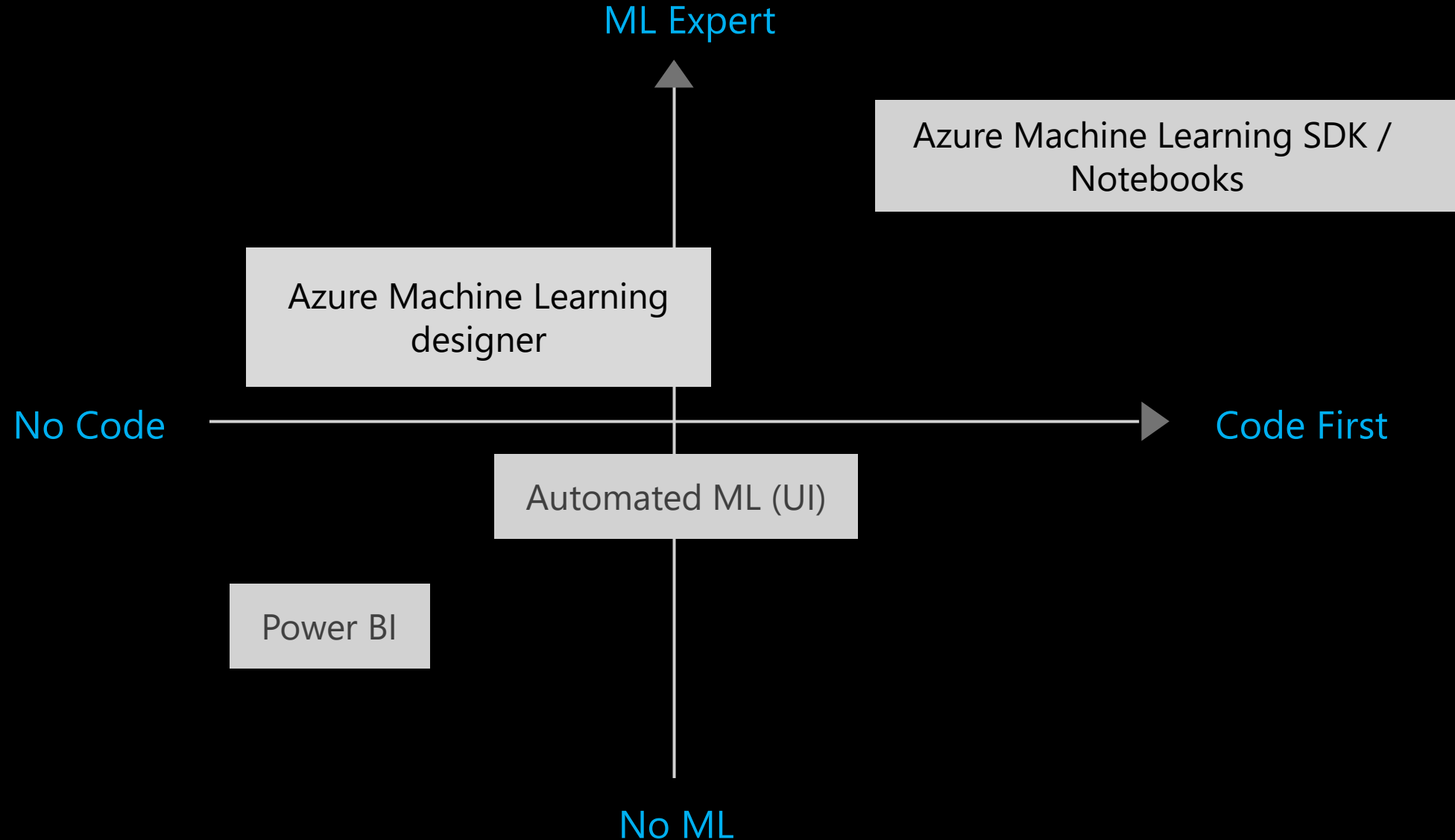
✓ Model reproducibility

✓ Model validation

✓ Model deployment

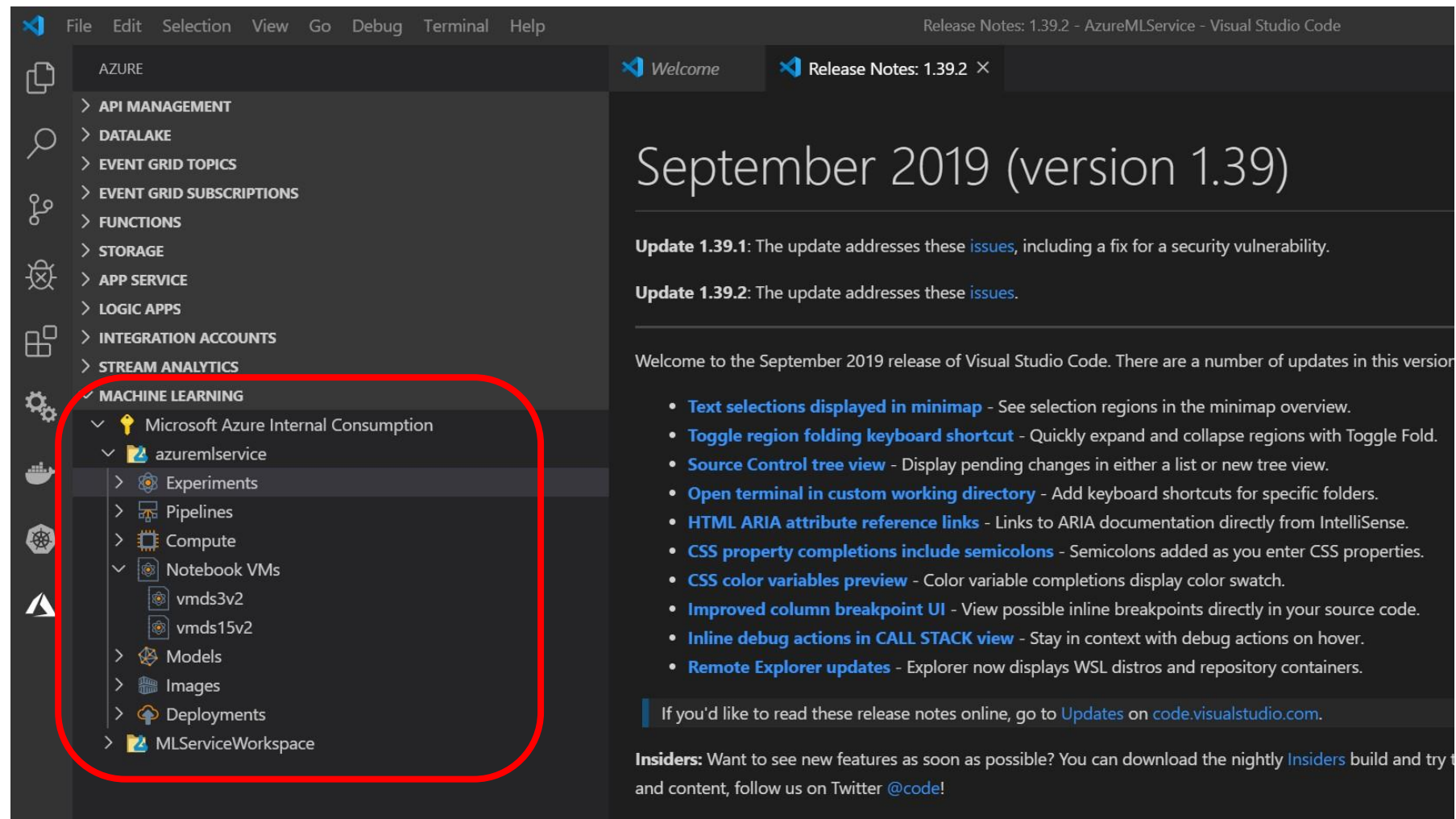
✓ Model retraining

# Build across skill levels with Azure Machine Learning



# Integration with VS Code

# Integration with Visual Studio



The screenshot displays the Visual Studio Code interface with the Azure extension. The left sidebar shows the 'AZURE' extension menu, which is highlighted with a red rounded rectangle. The menu items are: API MANAGEMENT, DATALAKE, EVENT GRID TOPICS, EVENT GRID SUBSCRIPTIONS, FUNCTIONS, STORAGE, APP SERVICE, LOGIC APPS, INTEGRATION ACCOUNTS, STREAM ANALYTICS, MACHINE LEARNING, Microsoft Azure Internal Consumption, azuremlservice, Experiments, Pipelines, Compute, Notebook VMs (with sub-items vmds3v2 and vmds15v2), Models, Images, Deployments, and MLServiceWorkspace. The main editor area shows the 'Release Notes: 1.39.2' for the AzureMLService extension. The release notes are for September 2019 (version 1.39) and include updates 1.39.1 and 1.39.2, which address security vulnerabilities. A list of new features and improvements is provided, including text selections in the minimap, region folding shortcuts, source control tree view, terminal in custom working directory, HTML ARIA attribute reference links, CSS property completions with semicolons, CSS color variables preview, improved column breakpoint UI, inline debug actions in the call stack view, and remote explorer updates. A link to the online release notes is also provided.

File Edit Selection View Go Debug Terminal Help

Release Notes: 1.39.2 - AzureMLService - Visual Studio Code

Welcome

Release Notes: 1.39.2 ✕

## September 2019 (version 1.39)

**Update 1.39.1:** The update addresses these [issues](#), including a fix for a security vulnerability.

**Update 1.39.2:** The update addresses these [issues](#).

Welcome to the September 2019 release of Visual Studio Code. There are a number of updates in this version

- **Text selections displayed in minimap** - See selection regions in the minimap overview.
- **Toggle region folding keyboard shortcut** - Quickly expand and collapse regions with Toggle Fold.
- **Source Control tree view** - Display pending changes in either a list or new tree view.
- **Open terminal in custom working directory** - Add keyboard shortcuts for specific folders.
- **HTML ARIA attribute reference links** - Links to ARIA documentation directly from IntelliSense.
- **CSS property completions include semicolons** - Semicolons added as you enter CSS properties.
- **CSS color variables preview** - Color variable completions display color swatch.
- **Improved column breakpoint UI** - View possible inline breakpoints directly in your source code.
- **Inline debug actions in CALL STACK view** - Stay in context with debug actions on hover.
- **Remote Explorer updates** - Explorer now displays WSL distros and repository containers.

If you'd like to read these release notes online, go to [Updates](#) on [code.visualstudio.com](#).

**Insiders:** Want to see new features as soon as possible? You can download the nightly [Insiders](#) build and try it out. For more news, tips, and content, follow us on Twitter [@code](#)!

# Roles

# Roles

- Standard roles
- Custom roles

Azure Machine Learning operation	Owner	Contributor	Reader
Create workspace	✓	✓	
Share workspace	✓		
Upgrade workspace to Enterprise edition	✓		
Create compute target	✓	✓	
Attach compute target	✓	✓	
Attach data stores	✓	✓	
Run experiment	✓	✓	
View runs/metrics	✓	✓	✓
Register model	✓	✓	
Create image	✓	✓	
Deploy web service	✓	✓	
View models/images	✓	✓	✓
Call web service	✓	✓	✓




# Roles

```
{
  "Name": "Data Scientist Demo",
  "Description": "Can create experiments, submit runs, deploy models to test environments; Cannot create compute or register datastores",
  "Actions": [
    "Microsoft.MachineLearningServices/workspaces/*/read",
    "Microsoft.MachineLearningServices/workspaces/*/action"
  ],
  "NotActions": [
    "Microsoft.MachineLearningServices/workspaces/computes/listKeys/action",
    "Microsoft.MachineLearningServices/workspaces/listKeys/action"
  ],
  "DataActions": [
    "Microsoft.MachineLearningServices/workspaces/*/read",
    "Microsoft.MachineLearningServices/workspaces/*/write",
    "Microsoft.MachineLearningServices/workspaces/*/delete",
    "Microsoft.MachineLearningServices/workspaces/*/action"
  ],
  "NotDataActions": [
    "Microsoft.MachineLearningServices/workspaces/services/aks/prod/write",
    "Microsoft.MachineLearningServices/workspaces/services/aks/prod/delete",
    "Microsoft.MachineLearningServices/workspaces/endpoints/pipelines/write",
    "Microsoft.MachineLearningServices/workspaces/endpoints/pipelines/delete",
    "Microsoft.MachineLearningServices/workspaces/datastores/write"
  ],
  "AssignableScopes": [
    "/subscriptions/e9b2ec51-5c94-4fa8-809a-dc1e695e4896"
  ]
}
```

<https://docs.microsoft.com/en-us/azure/machine-learning/service/how-to-assign-roles>

# Monitoring Azure ML

# Monitoring Azure ML with Azure Monitor

 **workshopmlRG - Insights (preview)**  
Resource group

Search (Ctrl+ /)

Deployments

Policies

Properties

Locks

Export template

Cost Management

Cost analysis

Cost alerts

Budgets

Advisor recommendations

Monitoring

Insights (preview)

Alerts

Metrics

Diagnostic settings

Logs

Refresh

Collapse all

Feedback

Help

Total resources

Active alerts







Application map

Filter by name...

Local : Last 24 hours

Group by app layer and resource type

Alerts Severity

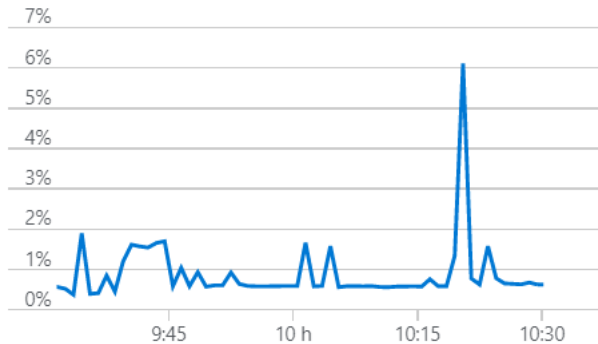
NAME	TOTAL ALERTS	SEV 0 ALERTS	SEV 1 ALERTS	INSIGHTS	ACTIONS
workshopmlRG	1 (-)	—	—		
Compute	1 (-)	—	—		
Virtual machine	1 (-)	—	—		
standardd2v224d142833d	—	—	—		...
standardds13v244d198275	1 (-)	—	—		...
Container registry	—	—	—		
Application	—	—	—		
Networking	—	—	—		
Other	—	—	—		
Storage and Databases	—	—	—		

# Monitoring Azure ML with Azure Monitor

Show data for last:

1 hour 6 hours 12 hours 1 day 7 days 30 days

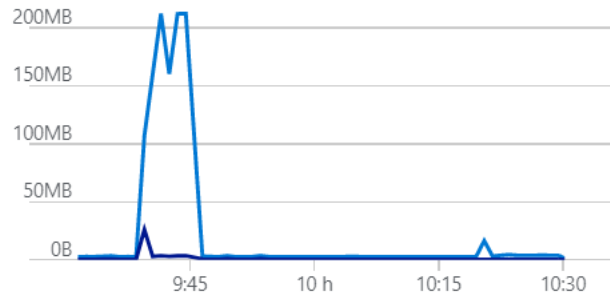
CPU (average)



Percentage CPU (Avg)  
standardds13v244d198275

**0,89 %**

Network (total)



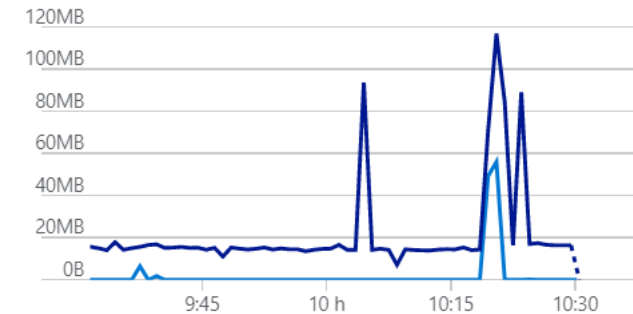
Network In Total (Sum)  
standardds13v244d198275

**1,34 GB**

Network Out Total (Sum)  
standardds13v244d198275

**63,08 MB**

Disk bytes (total)



Disk Read Bytes (Sum)  
standardds13v244d198275

**113,92 MB**

Disk Write Bytes (Sum)  
standardds13v244d198275

**1,26 GB**

# Monitoring Azure ML models

The screenshot displays the Azure ML Metrics dashboard for 'AMLServiceWS - Metrics'. The left sidebar contains a 'Monitoring' section with a red border, which includes 'Alerts', 'Metrics' (highlighted), 'Diagnostic settings', and 'Logs'. The main area shows a chart configuration interface with a 'Chart Title' field and buttons for 'Add metric', 'Add filter', and 'Apply splitting'. A dropdown menu is open for the 'METRIC' field, showing a list of metrics under 'MODEL' and 'QUOTA' namespaces. The 'MODEL' namespace includes 'Model Deploy Failed', 'Model Deploy Started', 'Model Deploy Succeeded', 'Model Register Failed', and 'Model Register Succeeded'. The 'QUOTA' namespace includes 'Active Cores'. A 'New alert rule' button is visible in the top right corner. At the bottom, a panel suggests actions: 'Filter + Split', 'Plot multiple metrics', and 'Build custom dashboards'.

**AMLServiceWS - Metrics**  
Machine Learning

Search (Ctrl+/)

Assets

- Experiments
- Pipelines
- Compute
- Models
- Images
- Deployments
- Activities

Settings

- Properties
- Locks
- Export template

**Monitoring**

- Alerts
- Metrics**
- Diagnostic settings
- Logs

Chart Title

+ New chart Refresh Share Feedback

Add metric Add filter Apply splitting

Line chart New alert rule

SCOPE: AMLServiceWS

METRIC NAMESPACE: Machine Learning S...

METRIC: Select metric

AGGREGATION: Select aggregation

MODEL

- Model Deploy Failed
- Model Deploy Started
- Model Deploy Succeeded
- Model Register Failed
- Model Register Succeeded

QUOTA

- Active Cores

Select a metric above to see data appear on this chart or learn more below:

- Filter + Split**  
Apply filters and splits to identify outlying segments
- Plot multiple metrics**  
Create charts with multiple metrics and resources
- Build custom dashboards**  
Pin charts to your dashboards

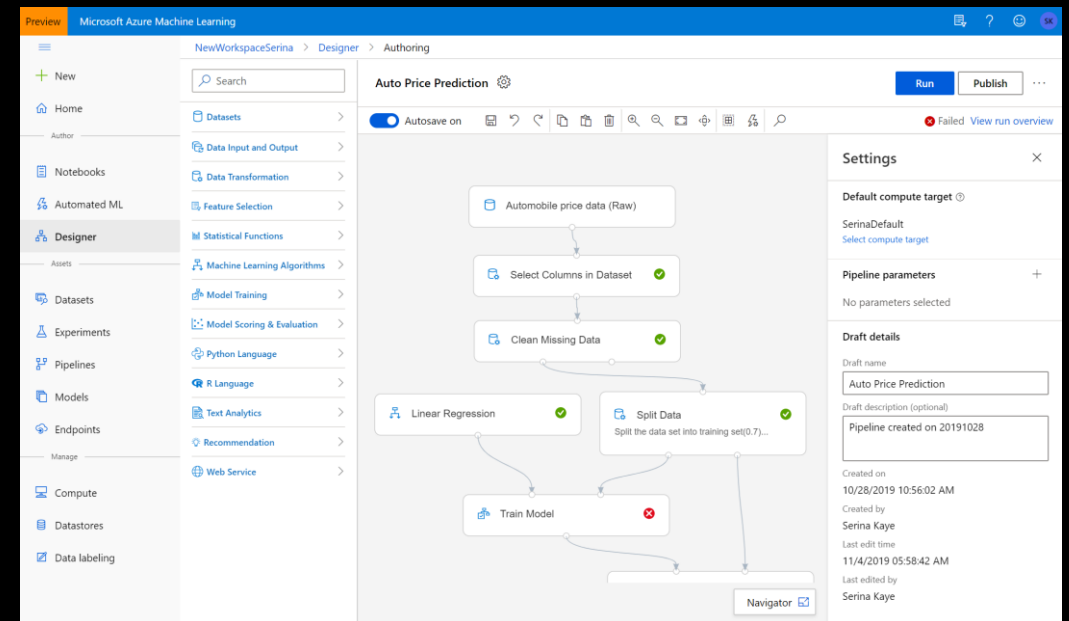
# Azure ML Editions

# Azure Machine Learning Enterprise Edition

- **Enterprise Edition**

At Ignite, we announced the new Azure Machine Learning Enterprise and Basic editions. The Enterprise edition contains our no-code ML capabilities (AutoML and designer) as well as cutting edge AutoML features such as DNNs, enterprise grade ML Ops capabilities such as data drift monitoring, and cross-workspace compute management

- The Enterprise edition is currently in preview. While in preview, customers with Enterprise workspaces will pay only for Azure resources consumed.
- All capabilities of AzureML that were in general availability before Ignite are now available in the "Basic" edition, now in GA. Basic workspaces will incur costs only for consumed Azure resources.



# Enterprise and Basic: Summary

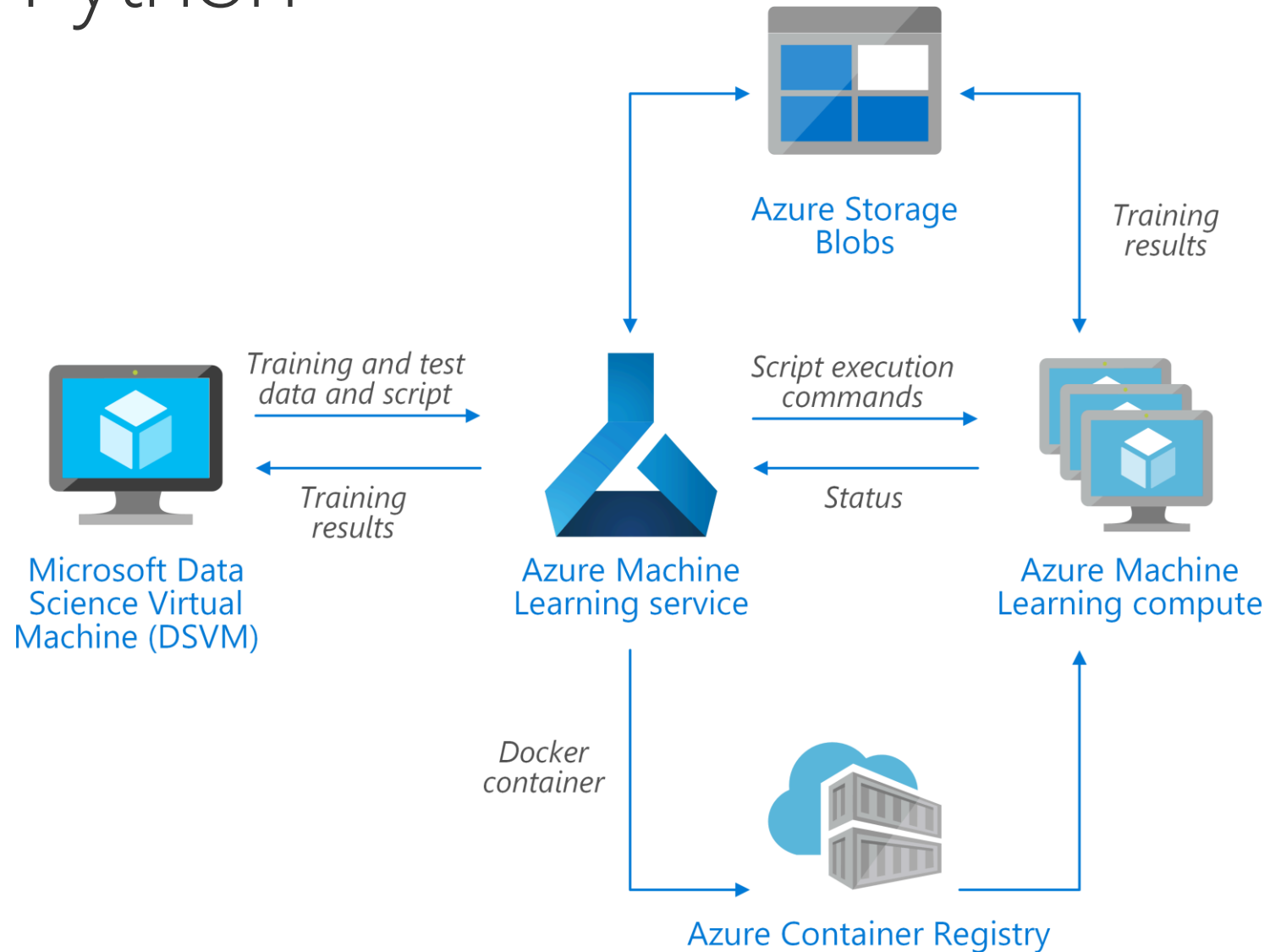
- Azure Machine Learning offers two editions: Enterprise and Basic
- Basic edition is available in GA / Enterprise edition currently in preview
- More detail on our pricing page: <https://azure.microsoft.com/en-us/pricing/details/machine-learning/>

	Basic	Enterprise
Pricing structure	<ul style="list-style-type: none"><li>• Pay only for Azure resources consumed</li><li>• No charge for AzureML</li></ul>	<ul style="list-style-type: none"><li>• No up-front cost – scale as you need, pay for what you consume</li><li>• Compute surcharge for ML activities: data prep, training, inferencing</li></ul>
Audience	<ul style="list-style-type: none"><li>• Experienced data scientists who like a code-first environment</li><li>• Single data scientists or small data science teams who don't need enterprise price controls, or large-scale ML Ops</li></ul>	<ul style="list-style-type: none"><li>• Large enterprises with mixed data science, data engineering and analyst teams who would benefit from both code-forward and drag-and-drop ML</li><li>• Large data science teams that need to share compute across workspaces, or access other enterprise features</li></ul>
Messages	<ul style="list-style-type: none"><li>• The best place for open source ML</li><li>• Use your existing tools and IDE when scaling to the cloud</li><li>• Best in class code-first experience</li></ul>	Basic level + <ul style="list-style-type: none"><li>• Best in class ML for all skill levels including no-code ML</li><li>• Enterprise-grade security, governance and cost control</li><li>• Comprehensive ML lifecycle management</li></ul>
[Roadmap features]	<ul style="list-style-type: none"><li>• Responsible AI toolkit</li><li>• Reinforcement learning</li><li>• Batch inferencing</li><li>• Manual data labelling</li></ul>	<ul style="list-style-type: none"><li>• Data drift capabilities</li><li>• Automated ML ensemble models and deep learning</li><li>• Automated model retraining</li><li>• Managed inferencing</li><li>• ML assisted labelling</li></ul>

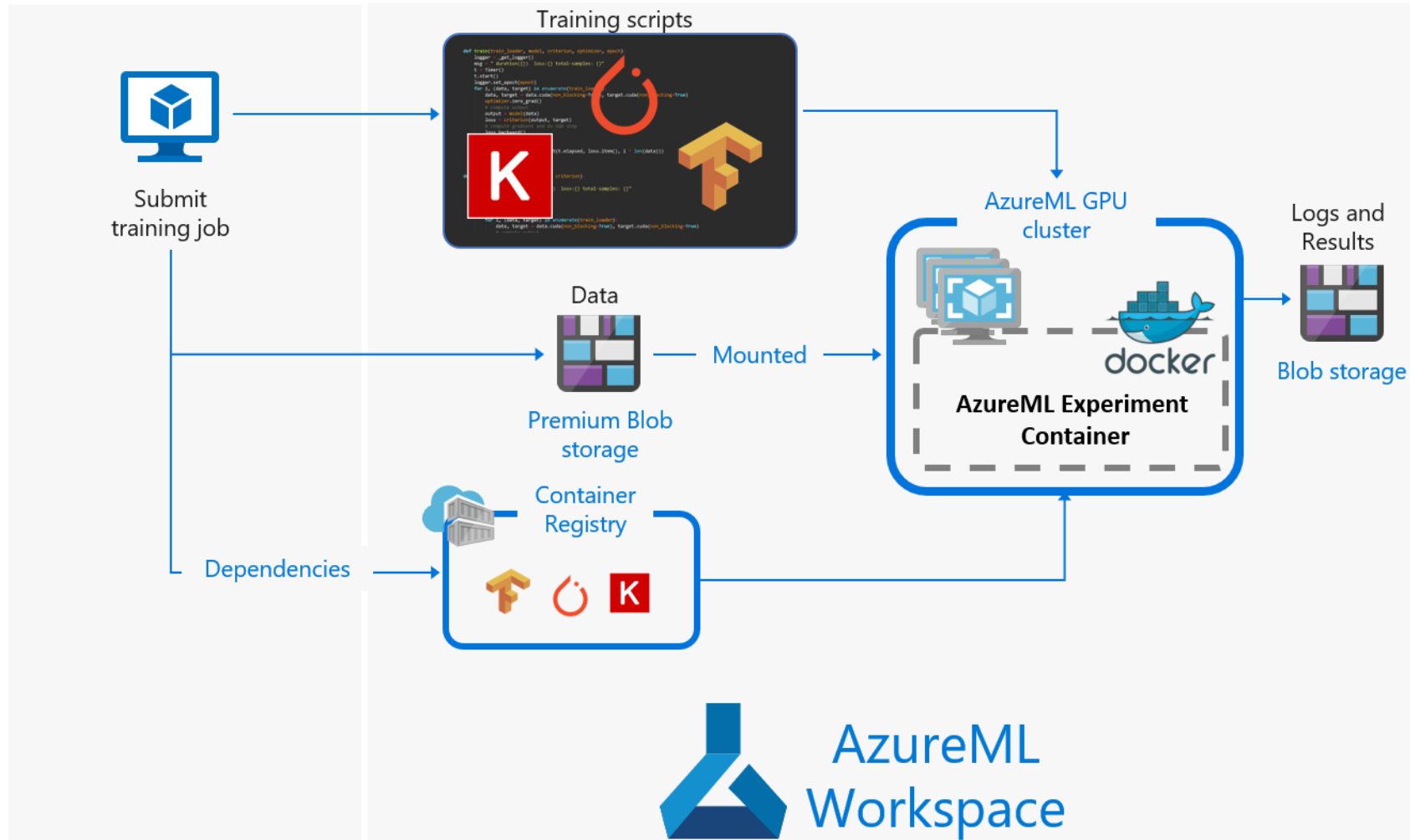


# Architectures

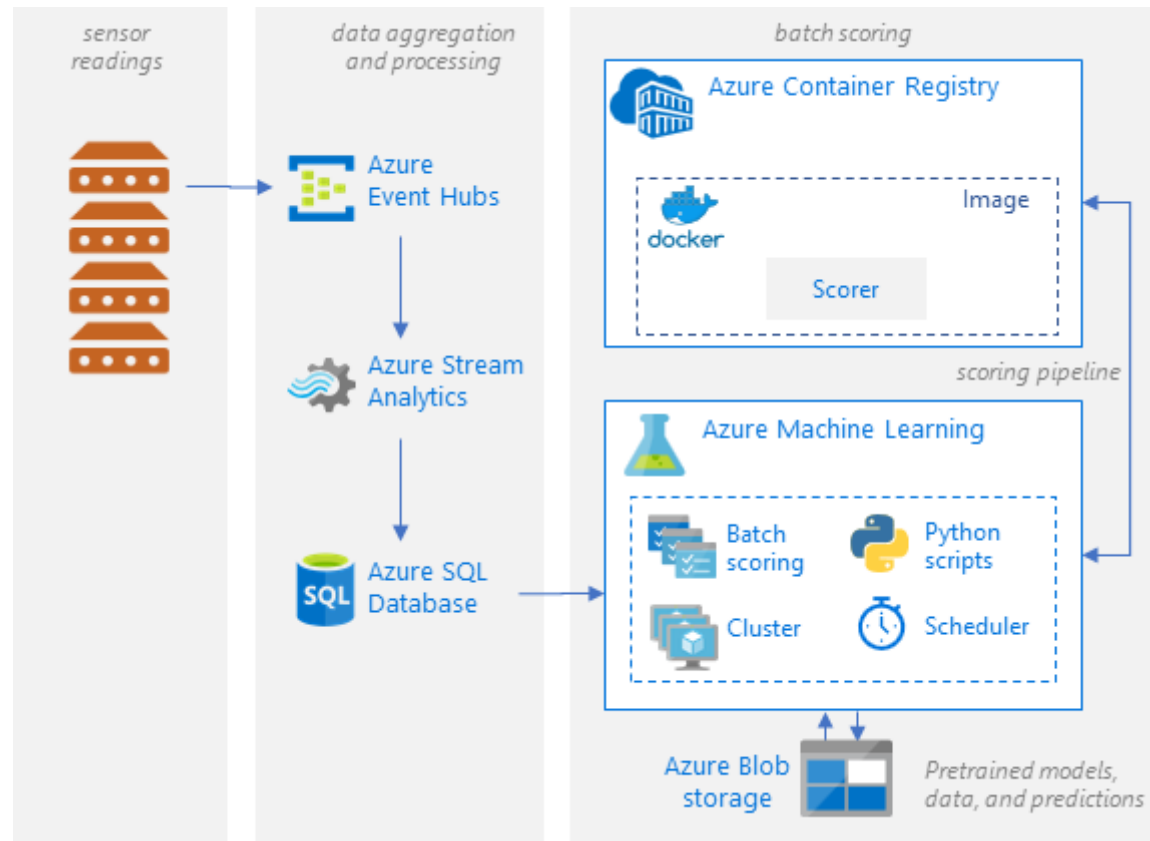
# Training Python



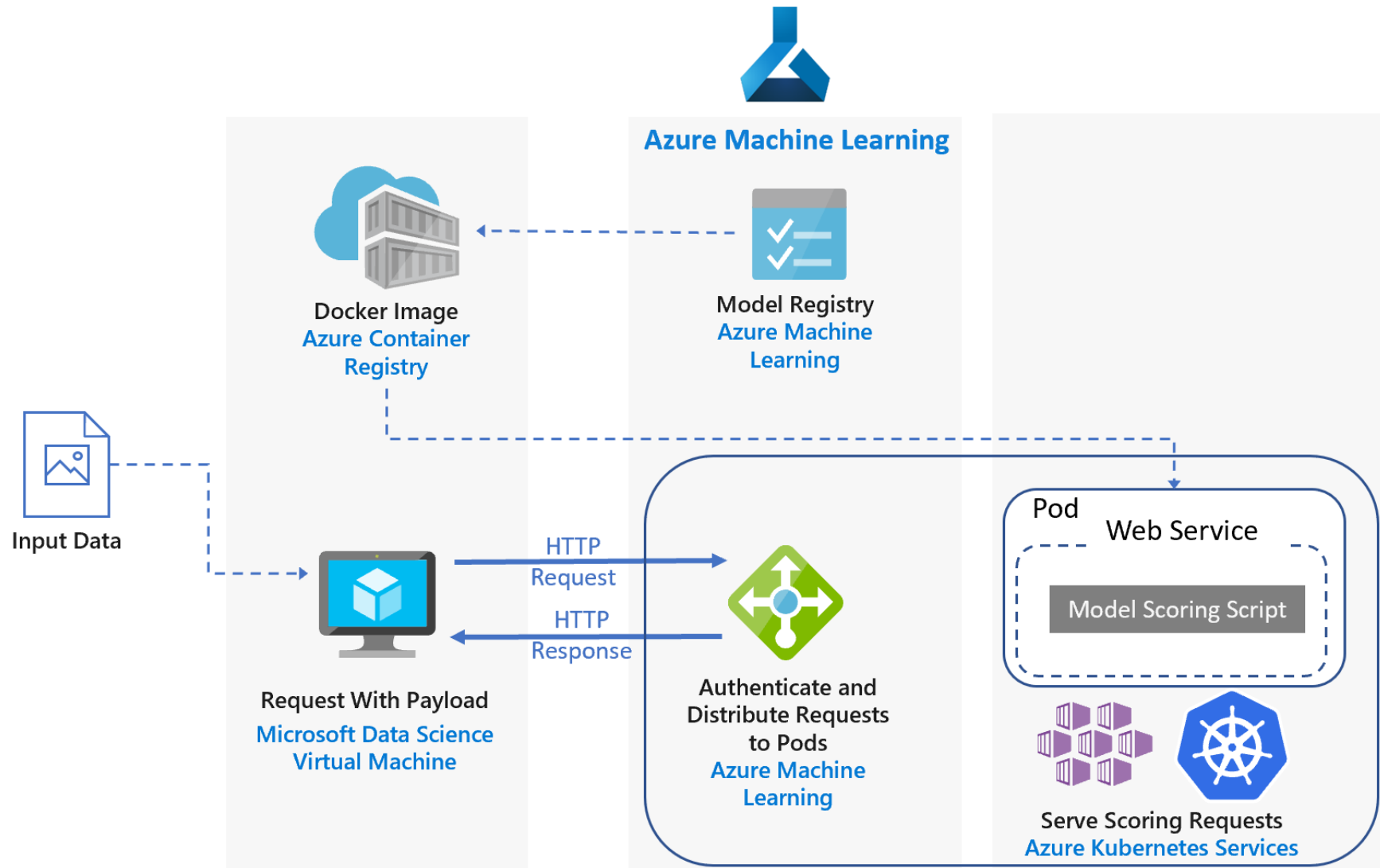
# Deep Learning



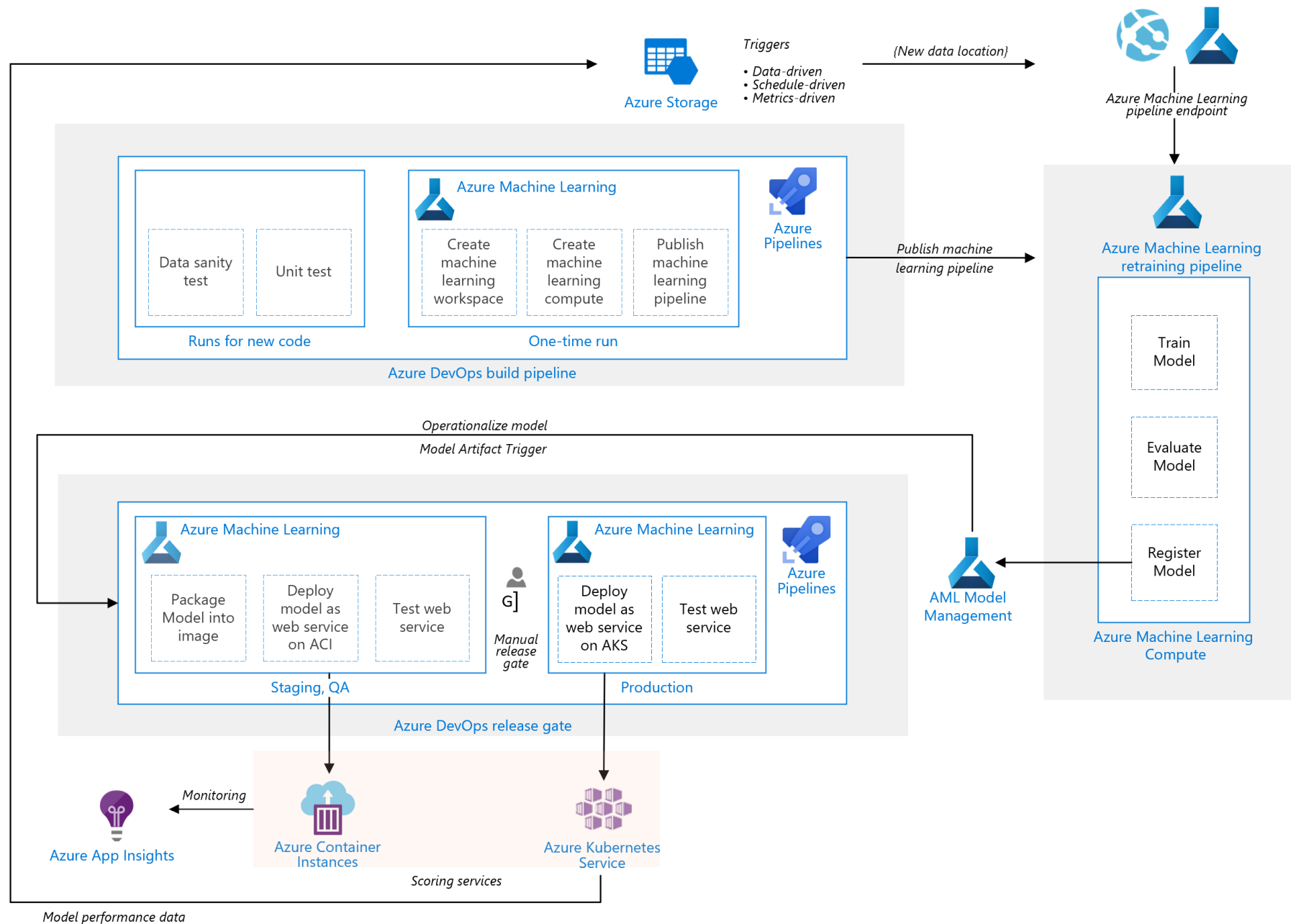
# Batch scoring of Python models



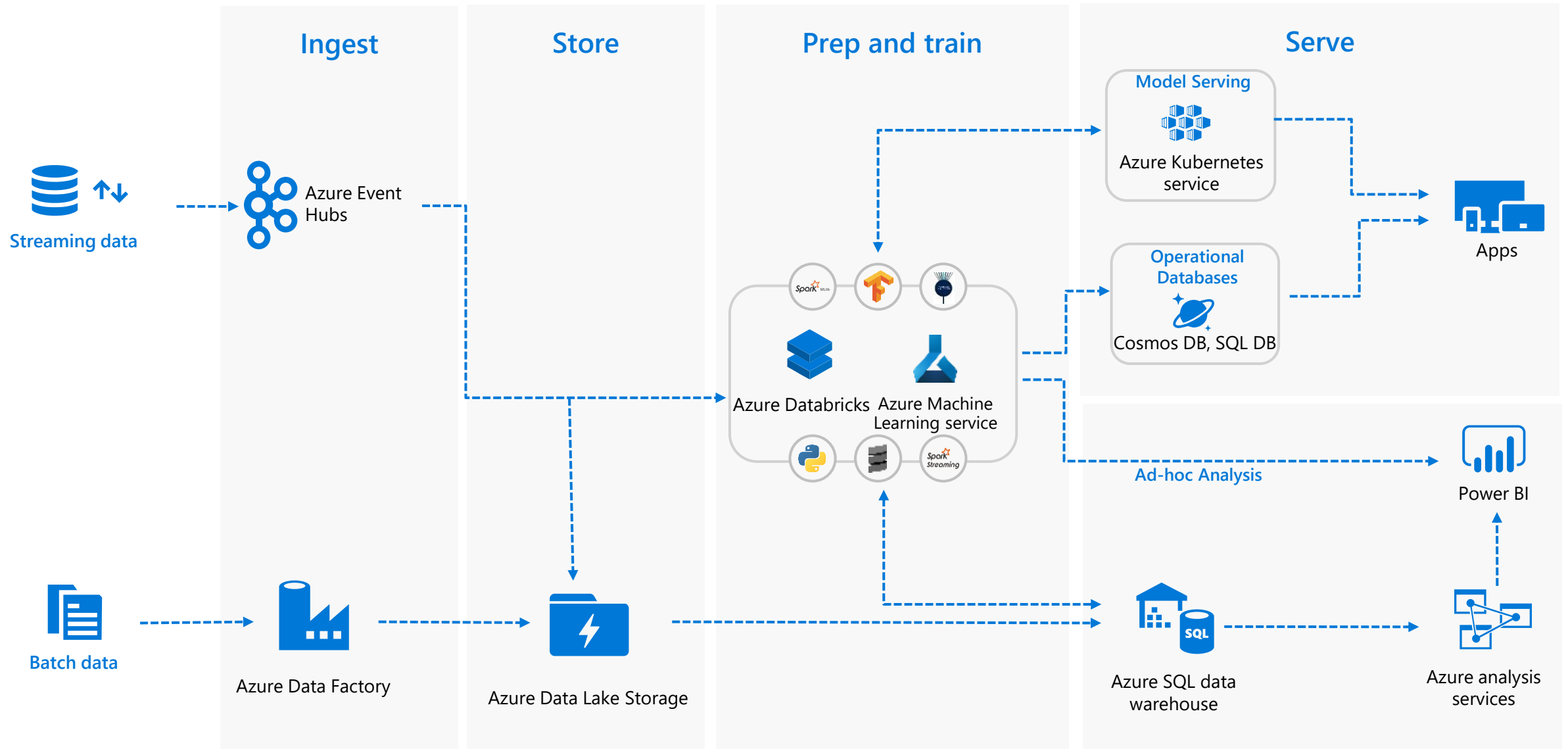
# Real time scoring



# MLOps



# Azure Databricks + Azure ML



# Documentation



# Documentation Azure ML



Lien général :

<https://azure.microsoft.com/en-us/services/machine-learning-service/>

Pricing :

<https://azure.microsoft.com/en-us/pricing/details/machine-learning-service/>

Documentation :

<https://docs.microsoft.com/en-us/azure/machine-learning/service/>

Concepts :

<https://docs.microsoft.com/en-us/azure/machine-learning/service/concept-azure-machine-learning-architecture>

Forum

<https://social.msdn.microsoft.com/Forums/en-US/home?forum=AzureMachineLearningService>

Addin Visual Studio

<https://marketplace.visualstudio.com/items?itemName=ms-toolsai.vscode-ai#overview>

Power BI Intégration

<https://docs.microsoft.com/en-us/power-bi/service-machine-learning-automated>

# AutoML with Azure ML

## References

Schneider Electric :

<https://customers.microsoft.com/en-us/story/schneider-electric-power-utilities-azure>

BP:

<https://news.microsoft.com/transform/bp-ai-drilling-data-fueling-smarter-decisions/>

Boots:

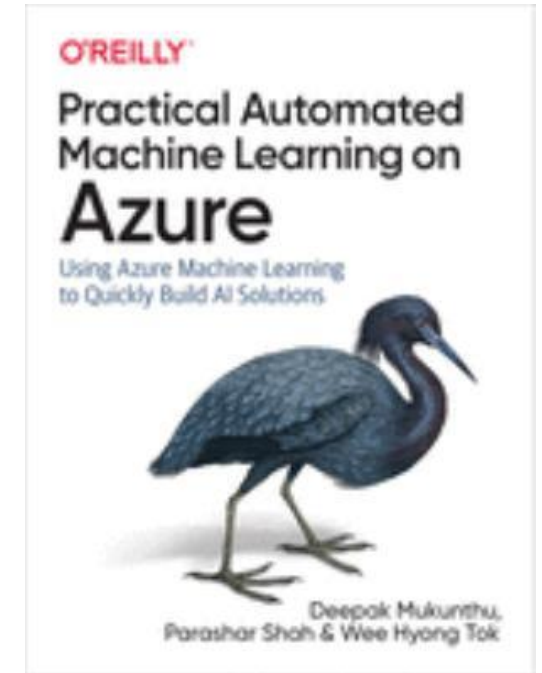
<https://customers.microsoft.com/en-us/story/733091-walgreens-boots-alliance-pharmaceuticals-azure>

AutoML integration with PowerBI:

<https://customers.microsoft.com/en-us/story/724164-macaw-partner-professional-services-power-bi>

Blog : <https://azure.microsoft.com/blog/announcing-automated-ml-capability-in-azure-machine-learning/>

Book: [https://www.amazon.com/Practical-Automated-Machine-Learning-Azure-ebook/dp/B07Y8X2HH4/ref=sr\\_1\\_1?keywords=automl+azure&qid=1573050215&s=digital-text&sr=1-1](https://www.amazon.com/Practical-Automated-Machine-Learning-Azure-ebook/dp/B07Y8X2HH4/ref=sr_1_1?keywords=automl+azure&qid=1573050215&s=digital-text&sr=1-1)

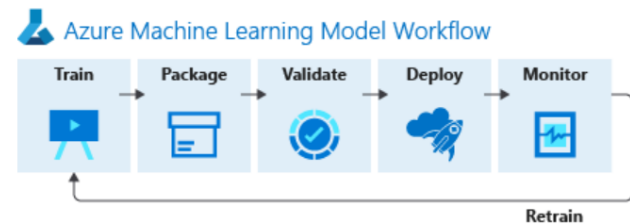


# Azure ML Git

<https://github.com/Azure/MachineLearningNotebooks/>

## Azure Machine Learning service example notebooks

This repository contains example notebooks demonstrating the [Azure Machine Learning](#) Python SDK which allows you to build, train, deploy and manage machine learning solutions using Azure. The AML SDK allows you the choice of using local or cloud compute resources, while managing and maintaining the complete data science workflow from the cloud.



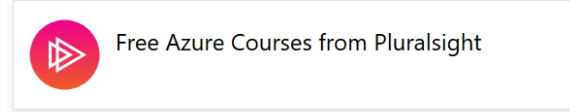
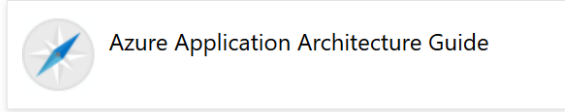
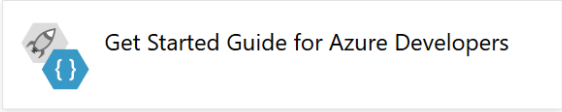
## Quick installation

```
pip install azureml-sdk
```

Read more detailed instructions on [how to set up your environment](#) using Azure Notebook service, your own Jupyter notebook server, or Docker.


## How to navigate and use the example notebooks?

If you are using an Azure Machine Learning Notebook VM, you are all set. Otherwise, you should always run the [Configuration](#) notebook first when setting up a notebook library on a new machine or in a new environment. It configures your notebook library to connect to an Azure Machine Learning workspace, and sets up your workspace and compute to be used by many of the other examples.





## Architecture

## Web

 App Service - Web Apps

 API Management

 Content Delivery Network

 Notification Hubs Azure Search



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Azure Architecture Center

&gt; Cloud fundamentals

&gt; Example scenarios

▼ Reference architectures

Overview

&gt; AI

&gt; Big data

&gt; Enterprise integration

&gt; Hybrid networks

&gt; Identity management

Internet of Things (IoT)

&gt; Microservices

&gt; Network DMZ

# Azure Reference Architectures

Our reference architectures are arranged by scenario. Each architecture includes recommended practices, along with considerations for scalability, availability, manageability, and security. Most also include a deployable solution or reference implementation.

Jump to: [AI](#) | [Big data](#) | [IoT](#) | [Microservices](#) | [Serverless](#) | [Virtual networks](#) | [VM workloads](#) | [SAP](#) | [Active Directory](#) | [Web apps](#)

## AI and machine learning



### Training of Python scikit-learn models

Recommended practices for tuning the hyperparameters of a scikit-learn Python model.



### Distributed training of deep learning models

Run distributed training of deep learning models across clusters of GPU-enabled VMs.



### Batch scoring of Python models

Batch score many Python models in parallel on a schedule using Azure Machine Learning.



### Batch scoring for deep learning models



### Real-time scoring of Python and deep learning models



### MLOps for Python models using Azure Machine Learning

# Architectures Microsoft

<https://docs.microsoft.com/en-us/azure/architecture/>

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