Introduction to mlflow

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databricks

Outline

ML development challenges

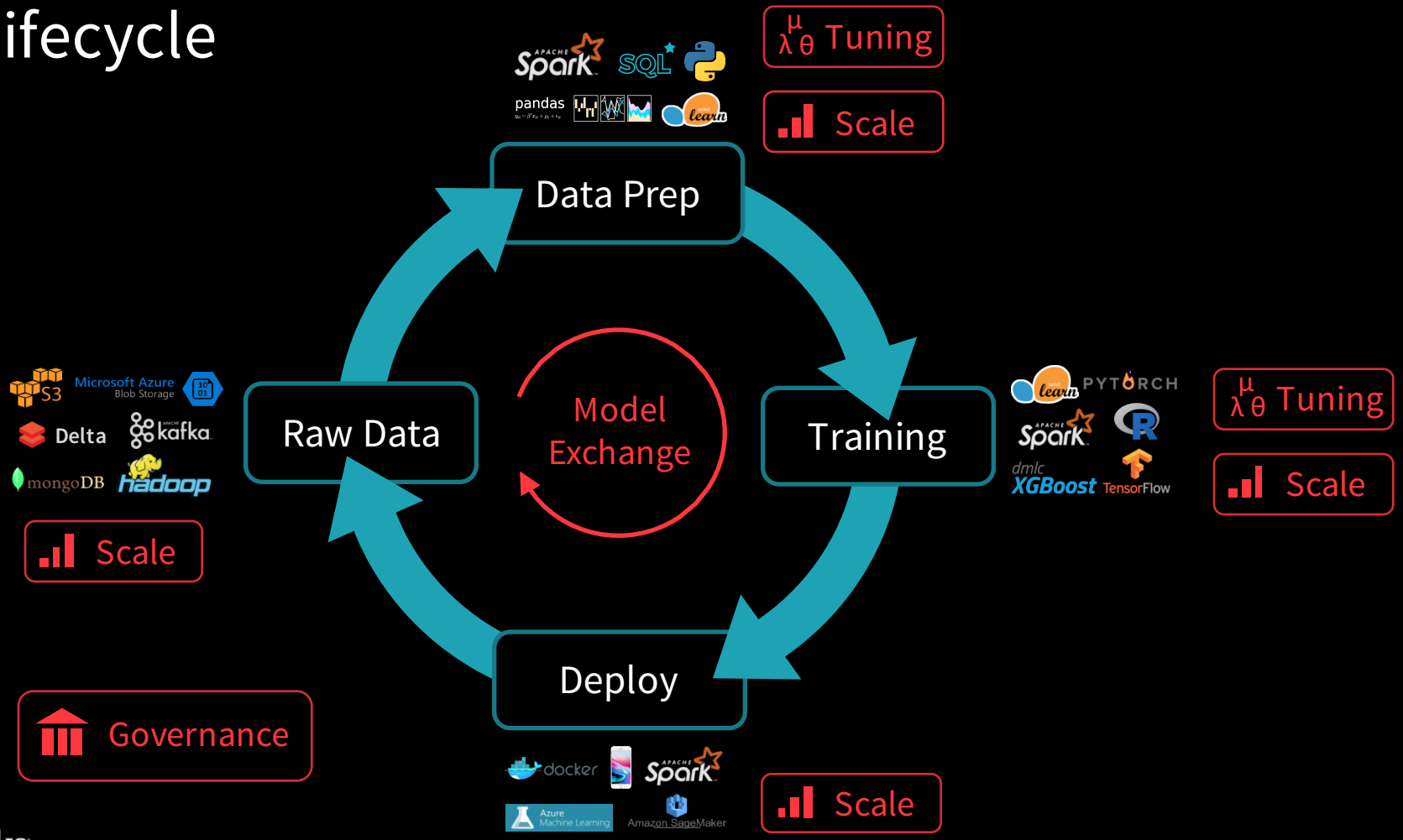
How MLflow tackles these

Demo

Roadmap

Machine Learning Development is Complex

ML Lifecycle



ML Development Challenges

100s of software tools to leverage

Hard to track & reproduce results: code, data, params, etc

Hard to productionize models

Needs large scale for best results

Introducing mlflow

Open machine learning platform

- Works with any ML library & language
- Runs the same way anywhere (e.g. any cloud)
- Designed to be useful for 1 or 100,000 person orgs

MLflow Design Philosophy

1. "API-first", open platform

- Allow submitting runs, models, etc from any library & language
- Example: a "model" can just be a lambda function that MLflow can then deploy in many places (Docker, Azure ML, Spark UDF, …)

Key enabler: built around REST APIs and CLI

MLflow Design Philosophy

2. Modular design

- Let people use different components individually (e.g., use MLflow's project format but not its deployment tools)
- Easy to integrate into existing ML platforms & workflows

Key enabler: distinct components (Tracking/Projects/Models)

Why Open Source?

Everyone is solving a similar problem

Lots of benefits in having a common API across orgs

- Can open source & share individual workflow steps
- ML tool developers can easily reach lots of users
  - E.g. a new ML library can use MLflow Models to reach many serving tools

MLflow Components

mlflow Tracking

Record and query experiments: code, data, config, results

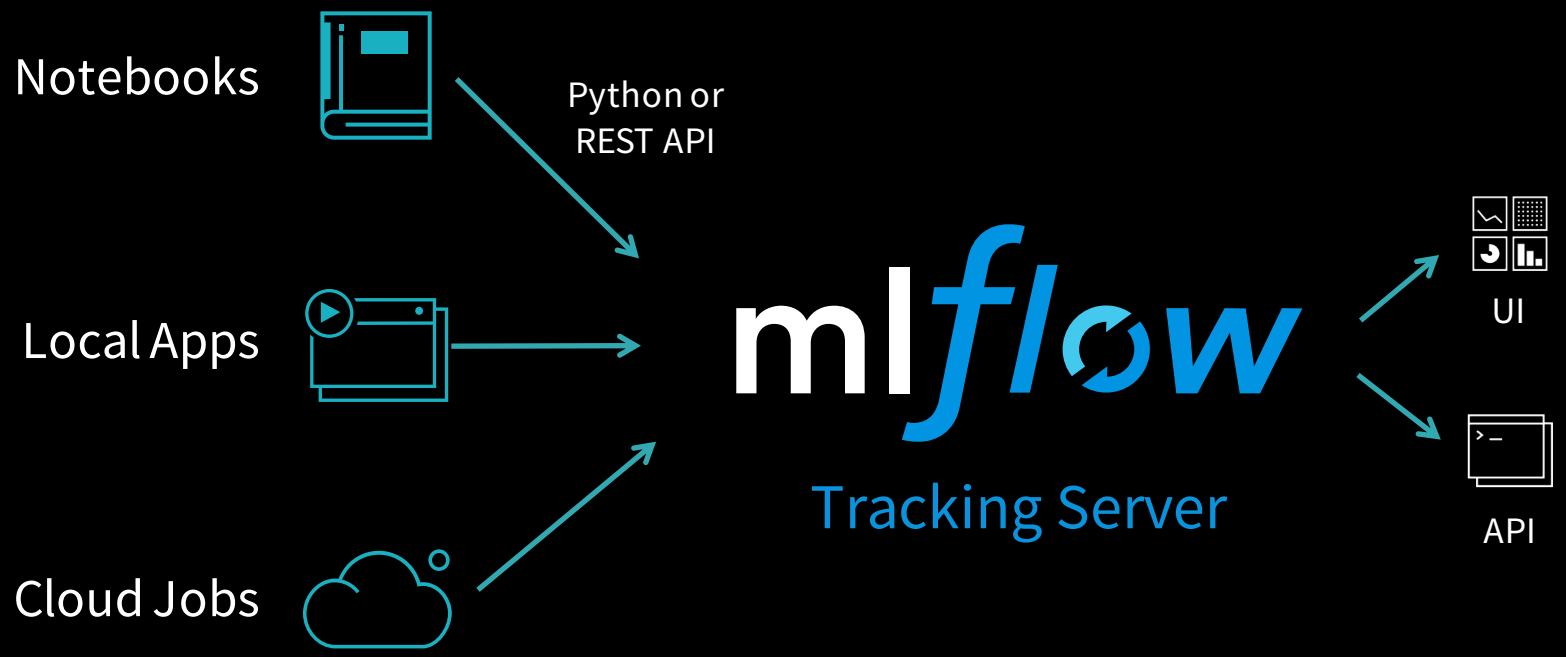
mlflow Projects

Packaging format for reproducible runs on any platform

mlflow Models

General model format that supports diverse deployment tools

MLflow Tracking



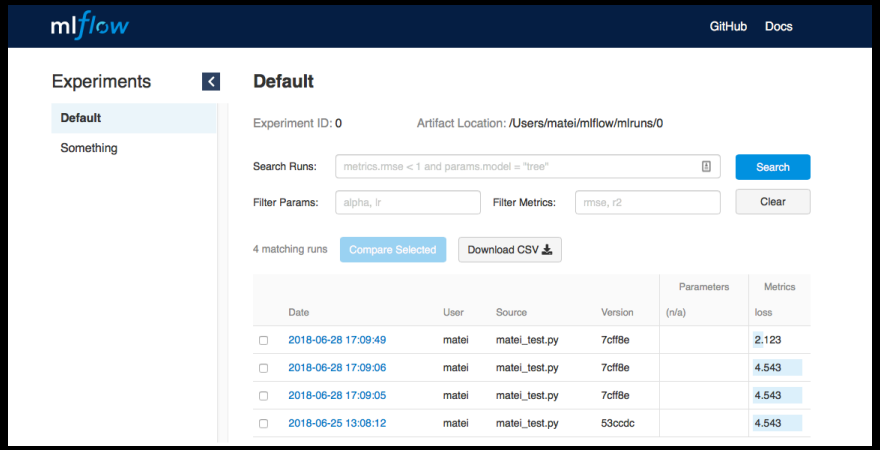
Key Concepts in Tracking

Parameters: key-value inputs to your code

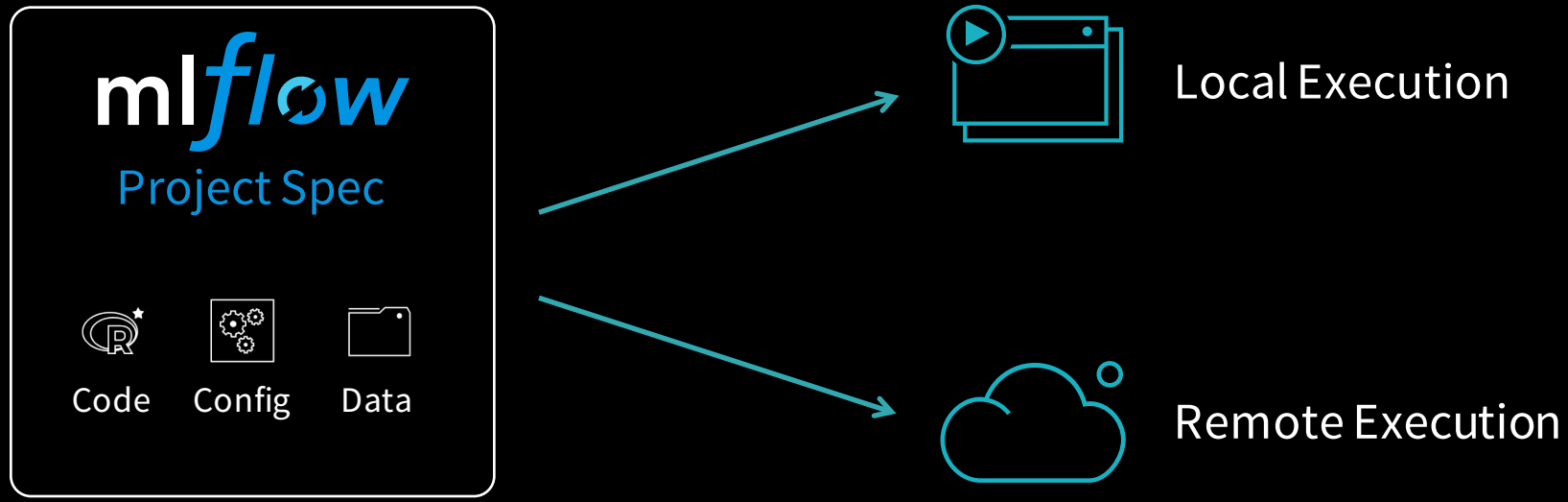
Metrics: numeric values (can update over time)

Artifacts: arbitrary files, including models

Source: what code ran?



MLflow Projects



Example MLflow Project

```
my_project/
├── MLproject
│
│
│
│
│
│
│
│
├── conda.yaml
├── main.py
└── model.py
    ...
```

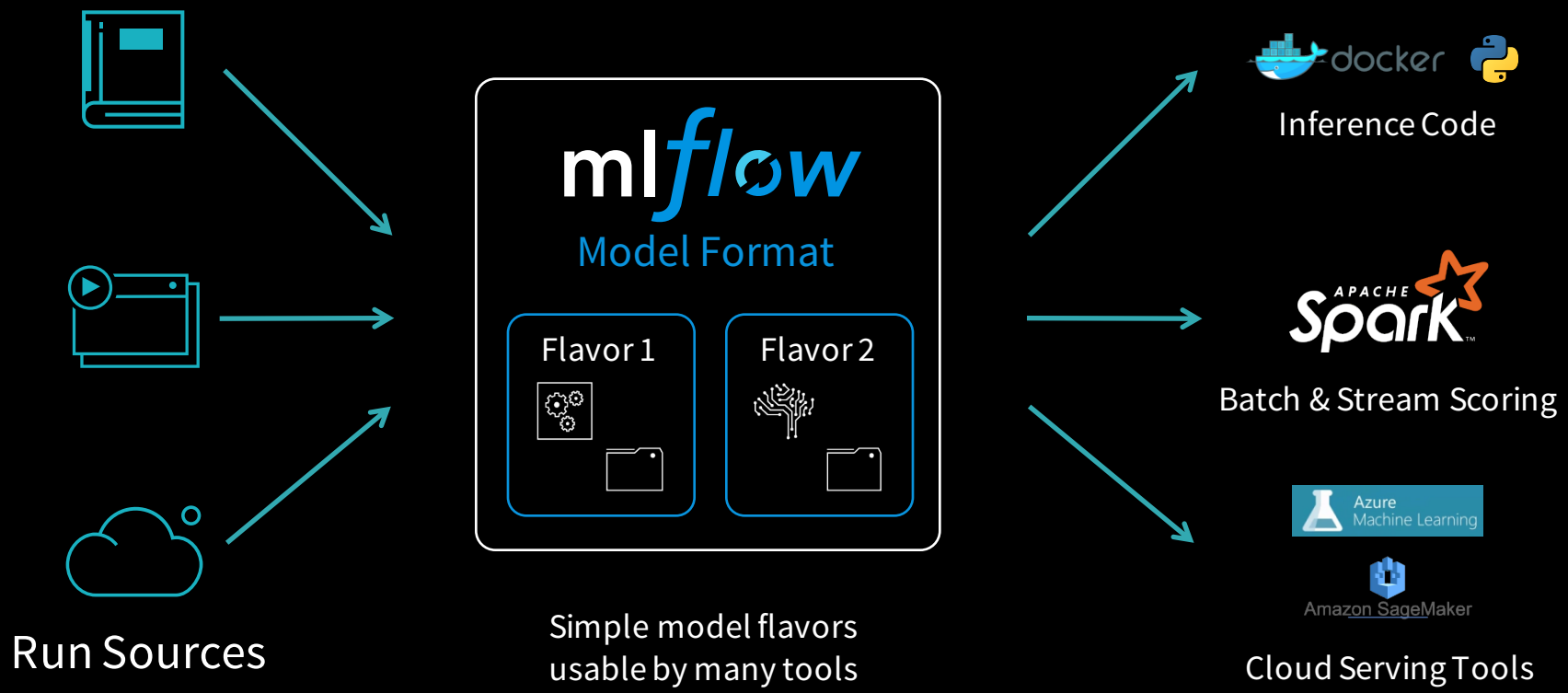
```yaml
conda_env: conda.yaml

entry_points:
  main:
    parameters:
      training_data: path
      lambda: {type: float, default: 0.1}
    command: python main.py {training_data} {lambda}
```

```
$ mlflow run git://<my_project>

mlflow.run("git://<my_project>", ...)
```

MLflow Models



Example MLflow Model

```
my_model/
├── MLmodel
│
│
│
│
│
│
│
│
│
└── estimator/
    ├── saved_model.pb
    └── variables/
        ...
```

```yaml
run_id: 769915006efd4c4bbd662461
time_created: 2018-06-28T12:34
flavors:
  tensorflow:
    saved_model_dir: estimator
    signature_def_key: predict
  python_function:
    loader_module: mlflow.tensorflow
```

Usable by tools that understand TensorFlow model format

Usable by any tool that can run Python (Docker, Spark, etc!)

Demo

Roadmap

Current Status

MLflow is still alpha, so expect things to break

- But send input or patches on GitHub!

Just made 0.3.0 release

- SparkML integration (model logging & serving)
- GCS artifact support
- Doc, example and API improvements

Longer-Term Roadmap

1. Improving current components

- Pluggable execution backends for `mlflow.run`
- Database-backed tracking store (already a pluggable API)
- Model metadata (e.g. required input schema)
- Easier support for multi-step workflows

Longer-Term Roadmap

2. MLflow Data component

- Let MLflow projects load data from diverse formats (e.g. CSV vs Parquet) so you don't have to pick a format in advance
- Will build on Spark's Data Source API

Longer-Term Roadmap

3. Hyperparameter tuning

- Integrate with common hyperparameter tuning libraries
- Make it easier to launch & track many runs in parallel (already possible but kind of awkward)

Longer-Term Roadmap

4. Language and library integrations

- Java and R are high on our list for APIs
- Built-in Spark MLlib and PyTorch integrations
- Demonstrate how to use MLflow with other libraries (it's easy)

Let us know if you have other roadmap ideas!

Contributing to MLflow

Submit issues and patches on GitHub

- We're using it for all our development & issue tracking
- See CONTRIBUTING.rst for how to run dev builds

Join our mailing list: tinyurl.com/mlflow-users

Join our Slack: tinyurl.com/mlflow-slack

Conclusion

Powerful workflow tools can simplify the ML lifecycle

- Improve usability for both data scientists and engineers
- Same way that software dev lifecycle tools simplify dev

MLflow is a lightweight, open platform that integrates easily into existing workflows

mlflow