Flyte: a Robust and end-to-end ML and Data Processing Platform

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04/26/2023

Flyte

whoami

- OSS Team lead @ Union.ai
- 10+ years of experience straddling the border between Infrastructure and Product
- ❤️ OSS

@curupa / eapolinario

Flyte

su UNION whoami

- Harness the power of Flyte without the overhead
- Free Data and ML teams from infra constraints
- https://union.ai/

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Motivation

📖 The Life of an ML Engineer

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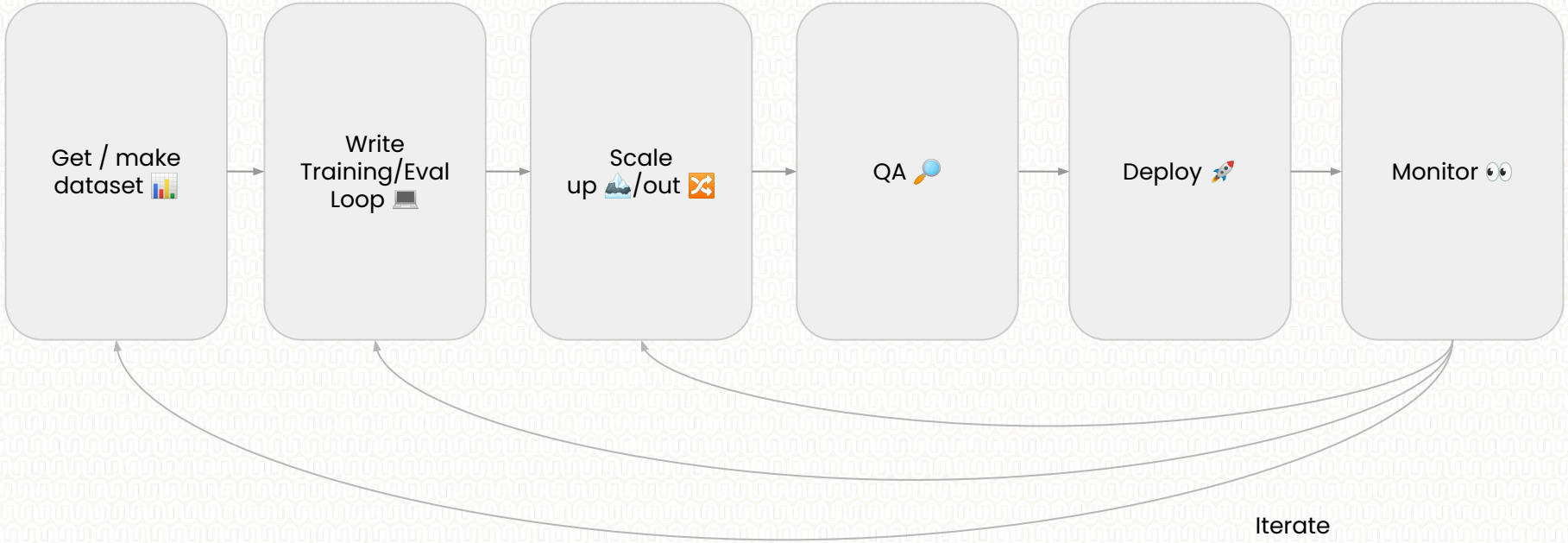
“My umpteenth ML project”



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Insights

- 🦾 ML pipelines *are* 📊 data pipelines
- Software is stateless ⬚, data is stateful ⬛
- If data shifts ⿻, models deteriorate 📉

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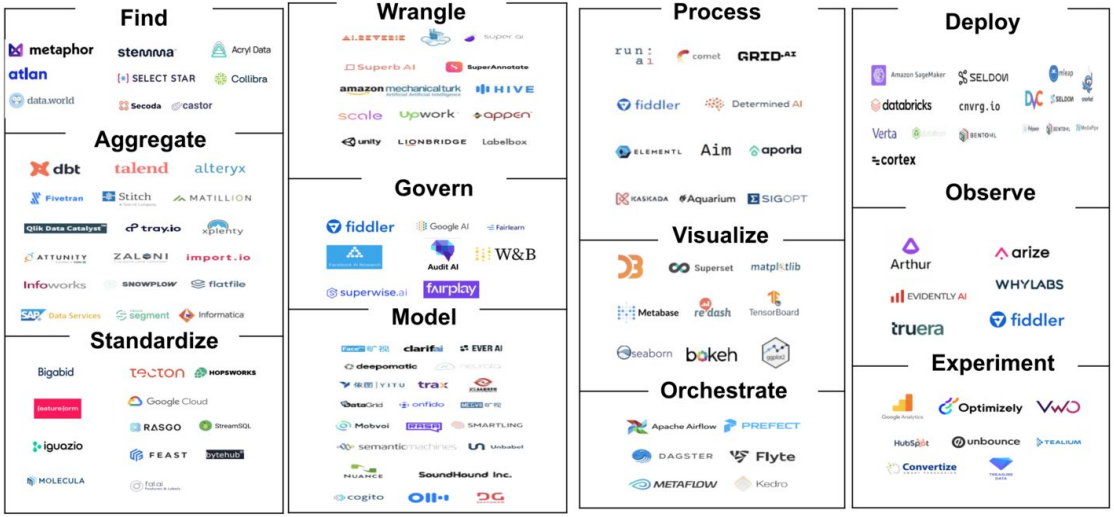
Why we built Flyte

Challenge 1

The ecosystem of tools is constantly and rapidly evolving



Credit: Sandeep Uttamchandani

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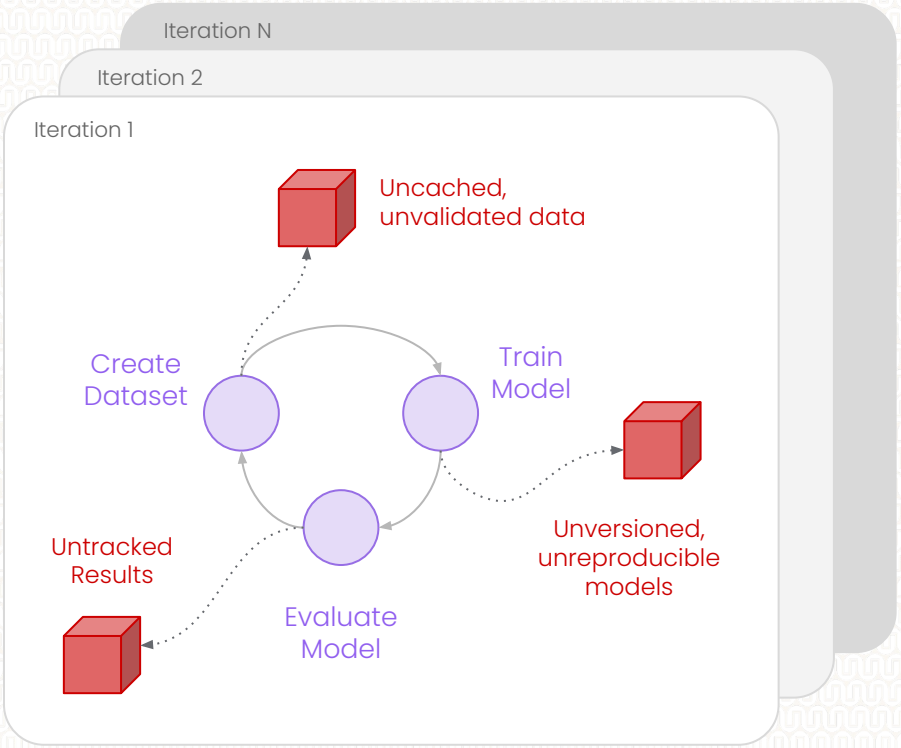
Challenge 2

Developing datasets & models can be wasteful and inefficient.



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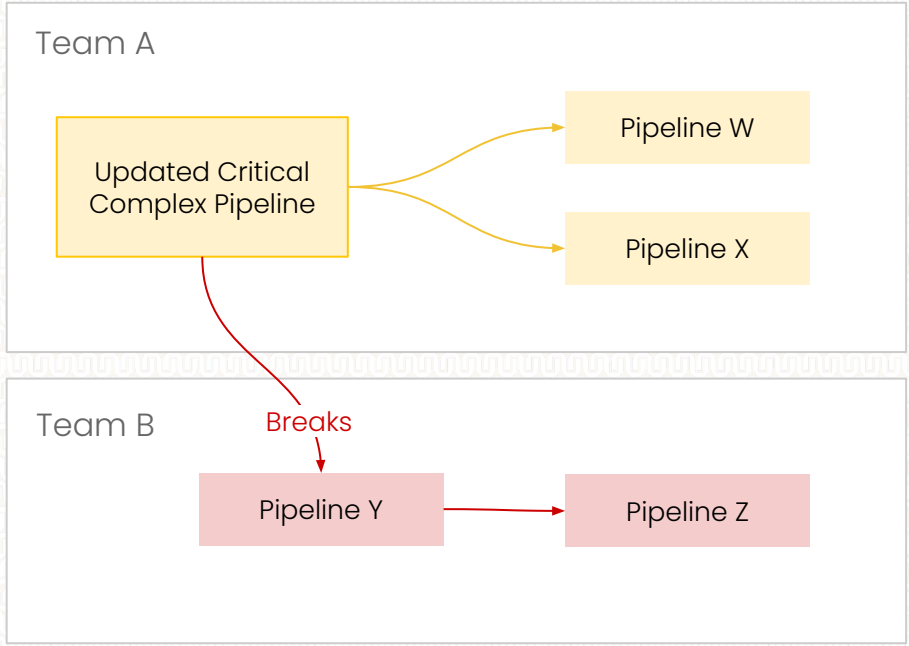
Challenge 3

Data/ML infrastructure doesn't scale well across teams/orgs



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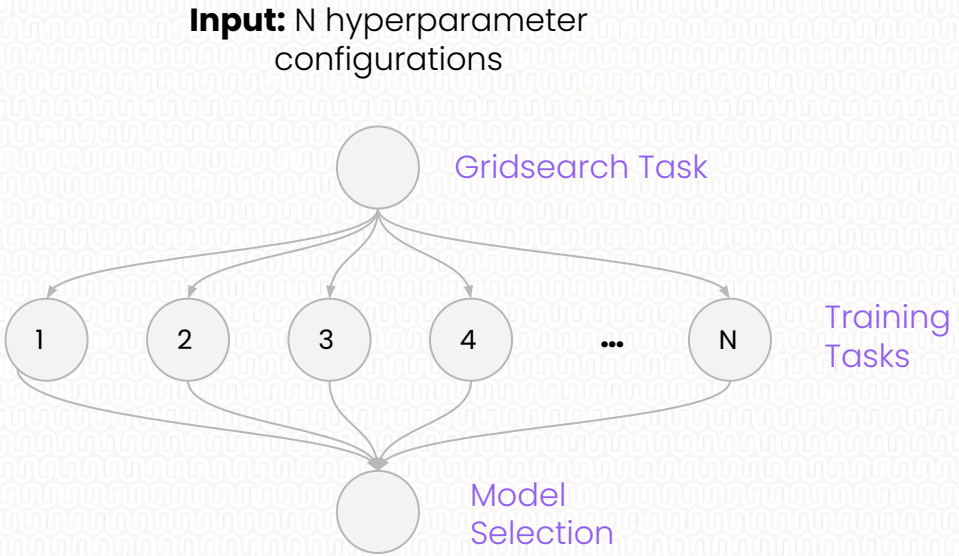
Challenge 4

Complex ML workflows require a dedicated infrastructure team

- **Provisioning CPU/GPU/Memory**
- **Framework/Library Independence**
- **Multi-tenancy**
- **Auto-scaling**
- **Efficiency:** Caching, Model Checkpoints
- **Cost Controls:** Spot Machines
- **Data Quality Assurance**
- **Model Monitoring**

Challenge 5

ML pipelines require dynamism, i.e. the execution graph depends on the inputs



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Orchestration to the rescue! ✨

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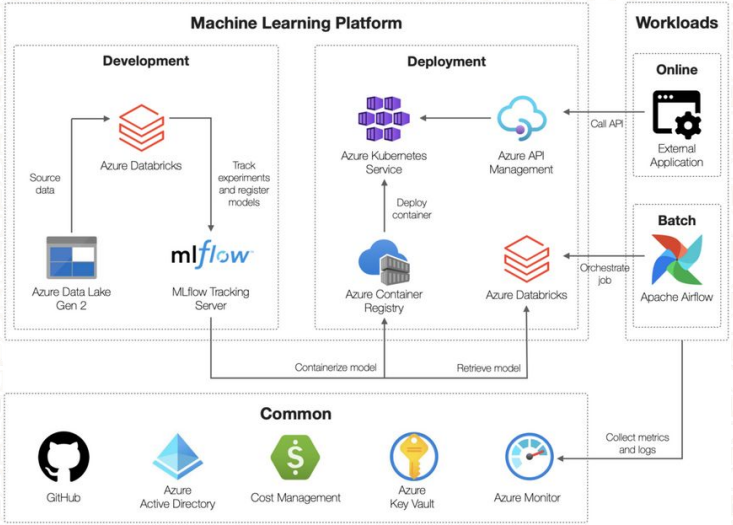
Orchestrators coordinate the logical flow of computations needed to get data from its *raw state* 🧱 into a *desired state* 🏠



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What would I want out of an orchestrator?

Challenges	Requirements
🚤 **Rapidly evolving ecosystem**	A future-proof system that's language- and framework- agnostic.
🗑️ **Data/model development inefficiency**	Out-of-the-box support for data lineage tracking, caching, immutability, and versioning.
🏔️ **Poor scaling across teams/orgs**	Isolated units of compute that can be arbitrarily composed together and reused across many different pipelines.
🔧 **Need for infrastructure expertise**	Declarative provisioning of compute, memory, disk requirements.
🔁 **Dynamic execution graphs**	Support for DAGs whose structure can be determined at runtime

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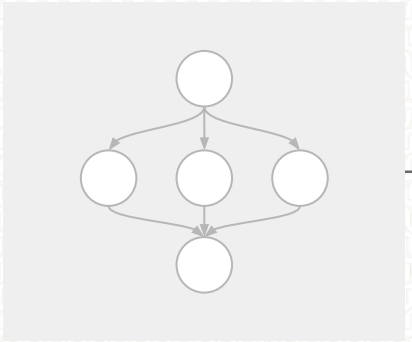
How does Flyte address these challenges?

Flyte Overview

💻 Create Tasks and Workflows

```
# workflows.py
from flytekit import task, workflow

...
```



Package & Register

Flyte Cluster

Config

Compiled Workflow

Container

Kubernetes Cluster

Workflow Execution

K8s Pod

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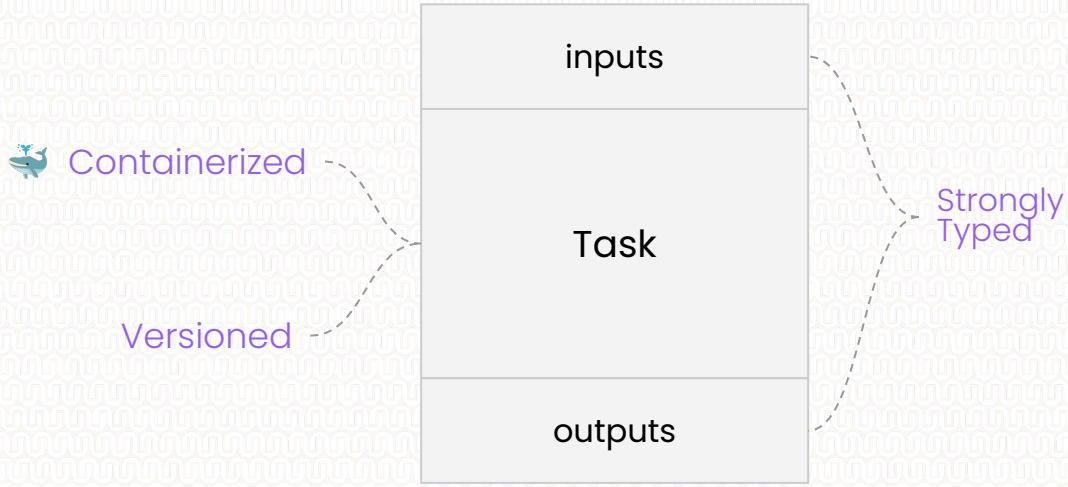
Tasks

The smallest unit of work in Flyte.



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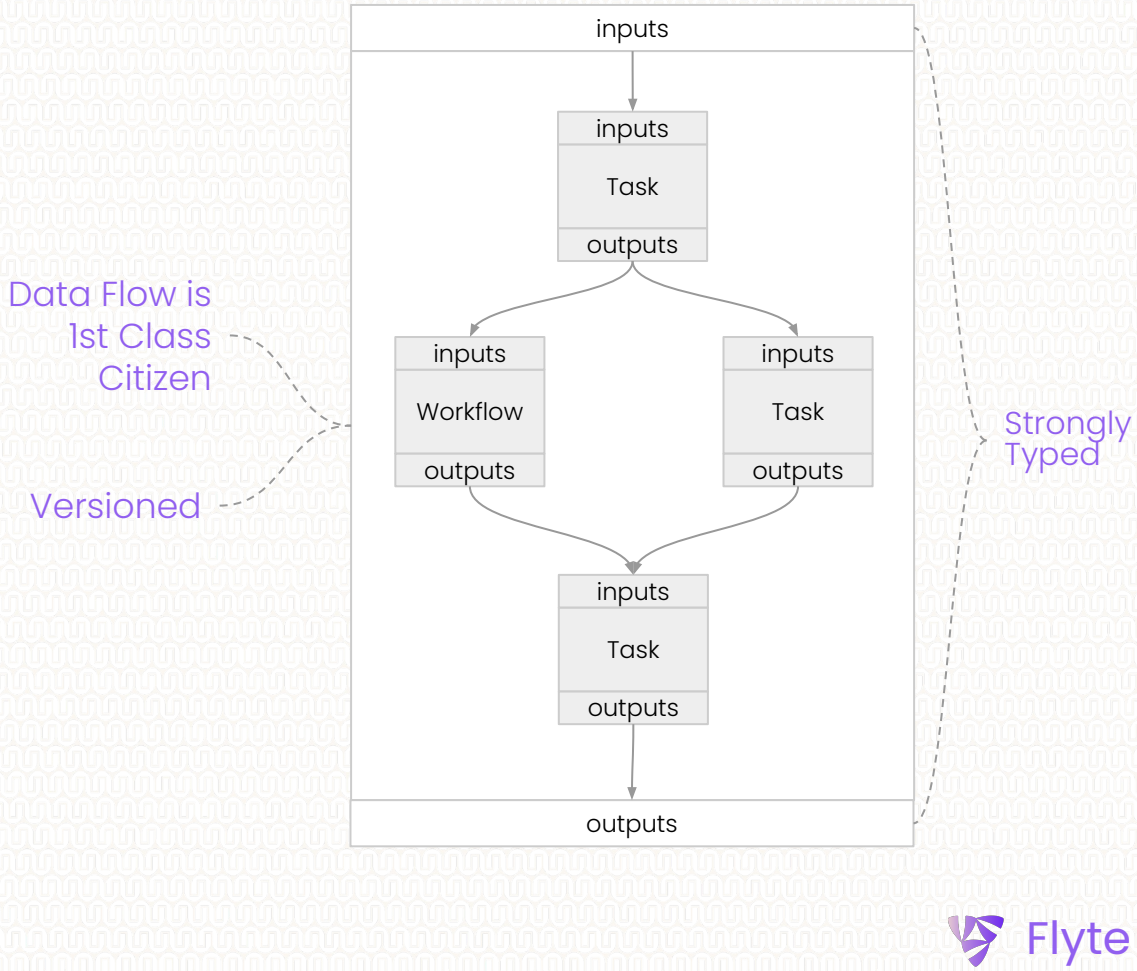
Workflows

Compositions of Tasks to achieve complex computations



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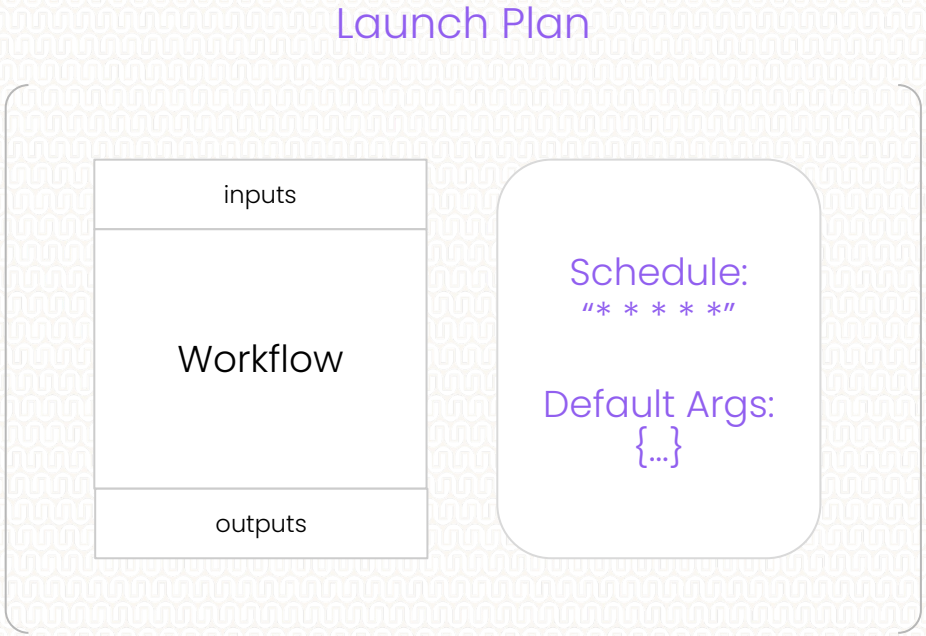
Launch Plans

Customizing and scheduling the invocation behavior of workflows



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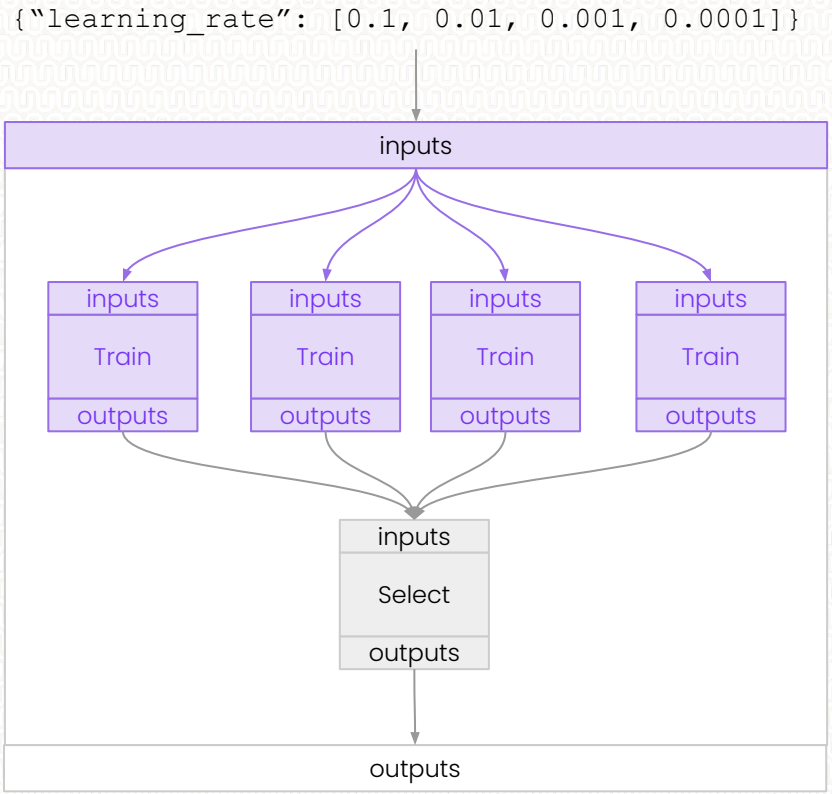
Dynamic Workflows

Compositions of Tasks to achieve complex computations



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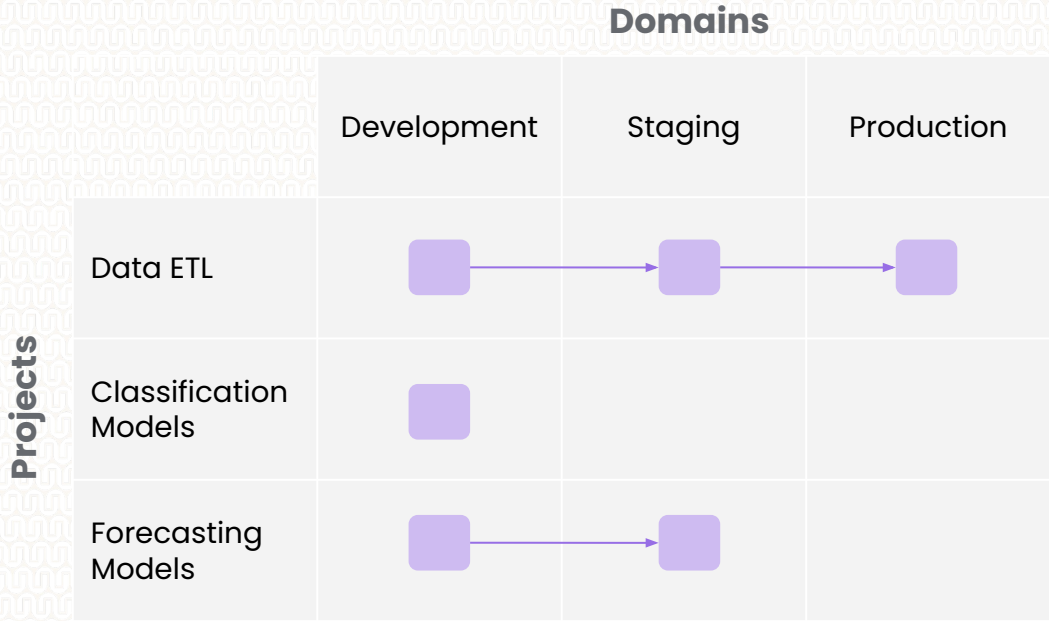
Projects and Domains

Logical groupings of tasks and workflows for built-in multi-tenancy and isolation.



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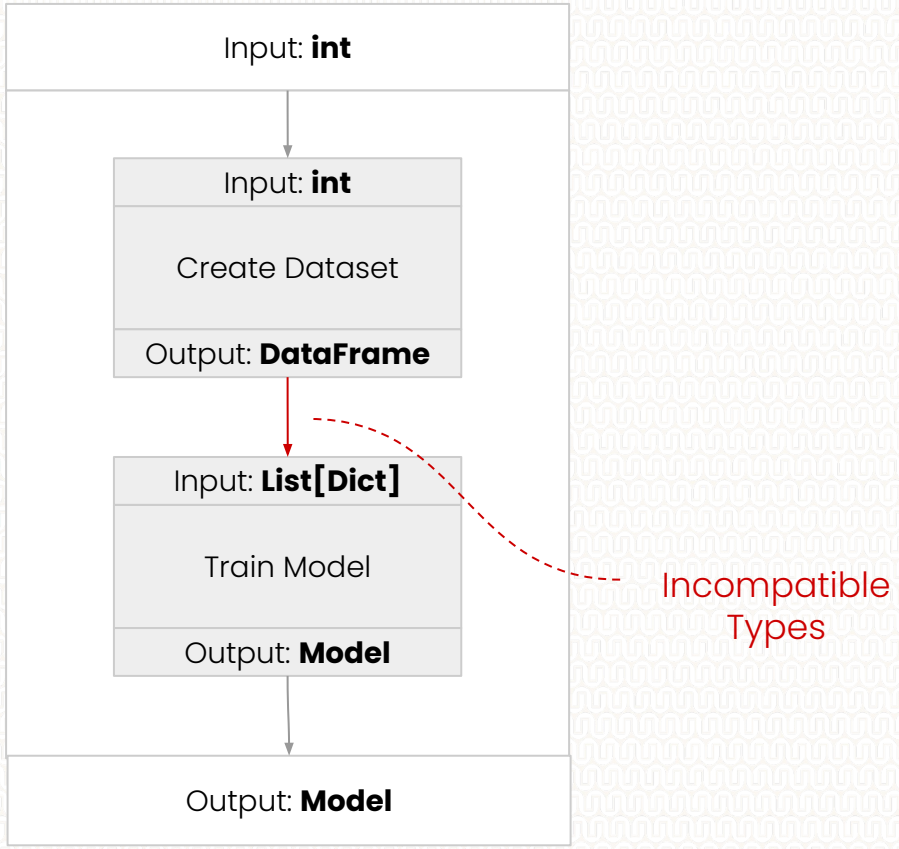
What's unique about Flyte?

Type Safety

Get errors about your execution graph at compile-time, even before executing your code



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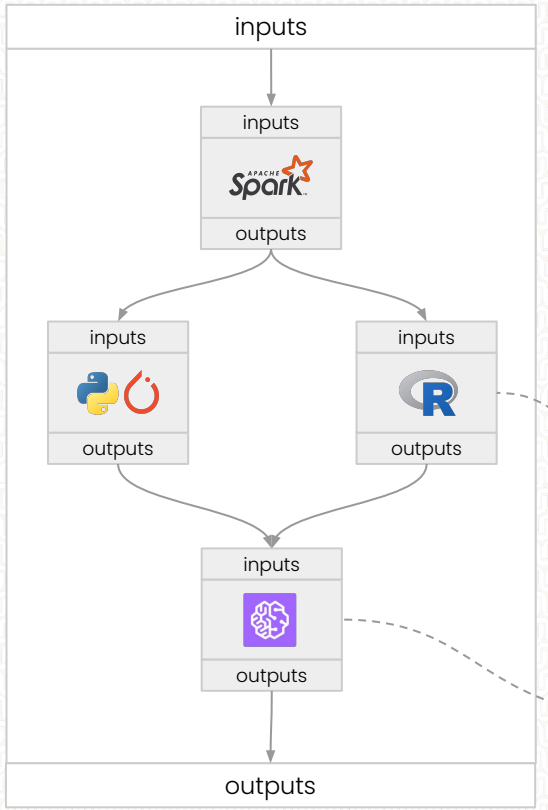
Language-independence

Create Workflows in Python, Java, and Scala.



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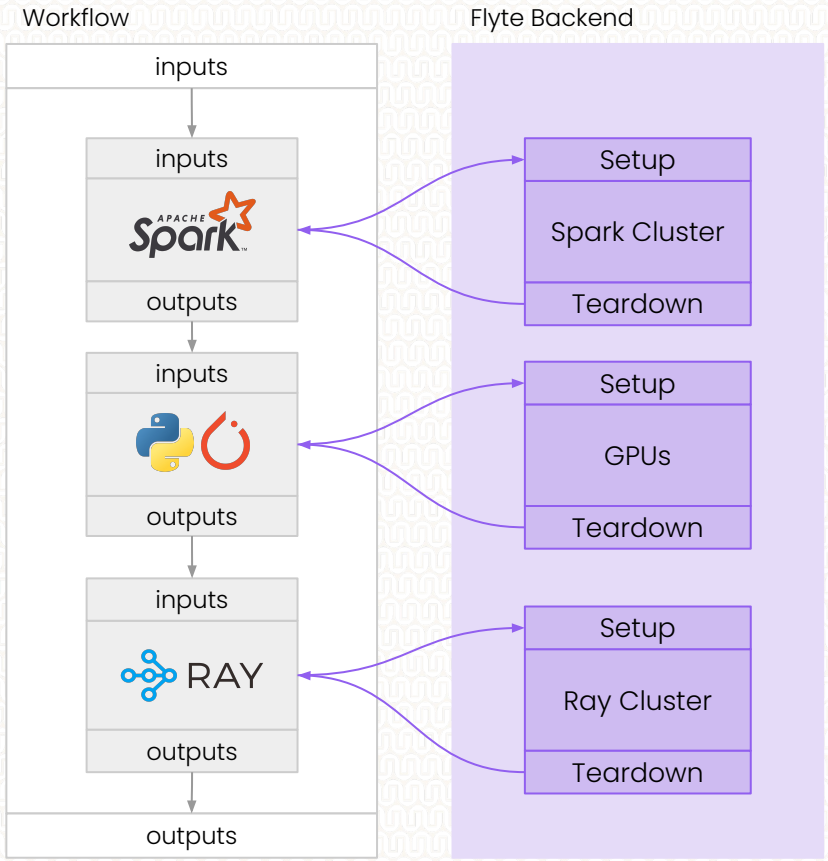
Declarative Infrastructure

Declaratively provisions ephemeral cluster, CPU/GPU, and memory resources.



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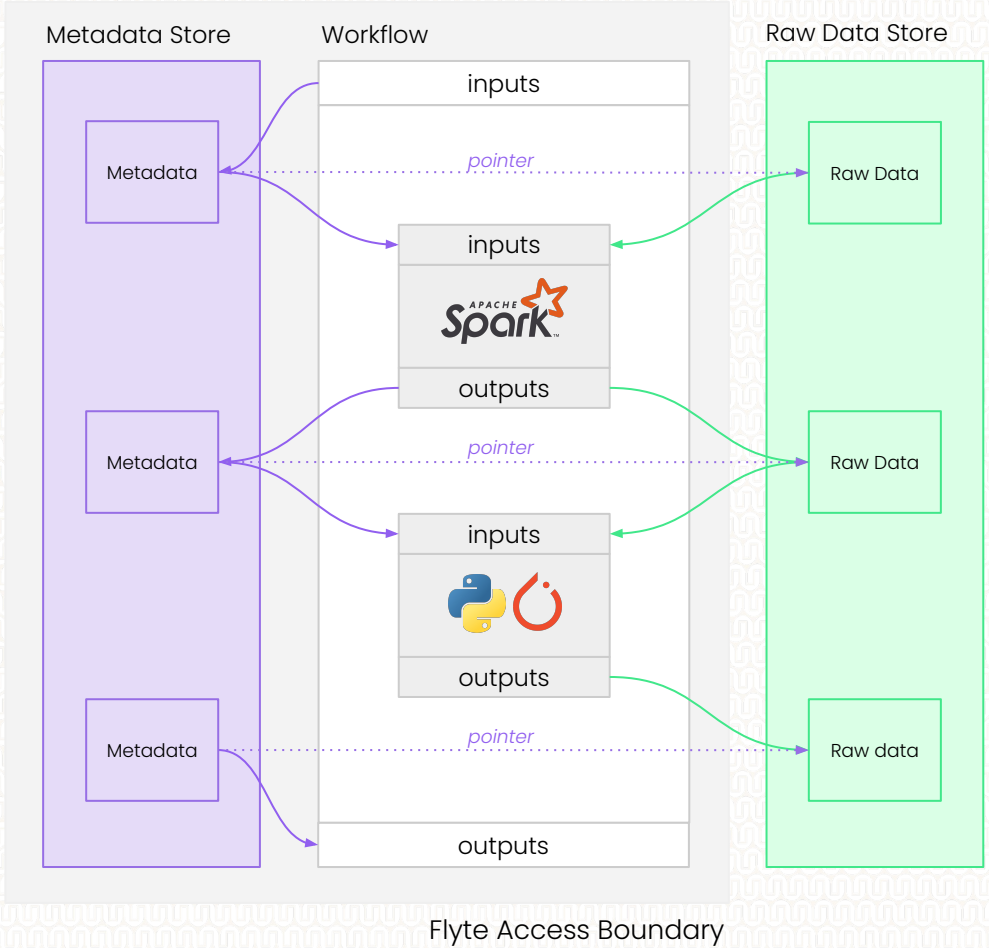
Abstracted Data Persistence

Don't worry about how data is serialized/deserialized as your execution graph runs



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How are People Using Flyte?

Spotify

Use Case:
End-to-end profit & loss forecasting

Flyte's Impact:

Increases velocity to deliver models

Breaks down silos between teams

freenome

Use Case:
Early detection of cancer via ML

Flyte's Impact:

Powers full data and ML stack

Accelerates clinical research

blackshark.ai

Use Case:
Digital 3D Mapping of the World

Flyte's Impact:

Enables processing ~2.5 petabytes of data

Unlocks multi-cloud provider capabilities

gojek

Use Case:
Price optimization, rider matching, etc.

Flyte's Impact:

Easily roll back critical pipeline bugs

Unlocks scale and reliability of pipelines

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Building a Model Training Pipeline with Flyte

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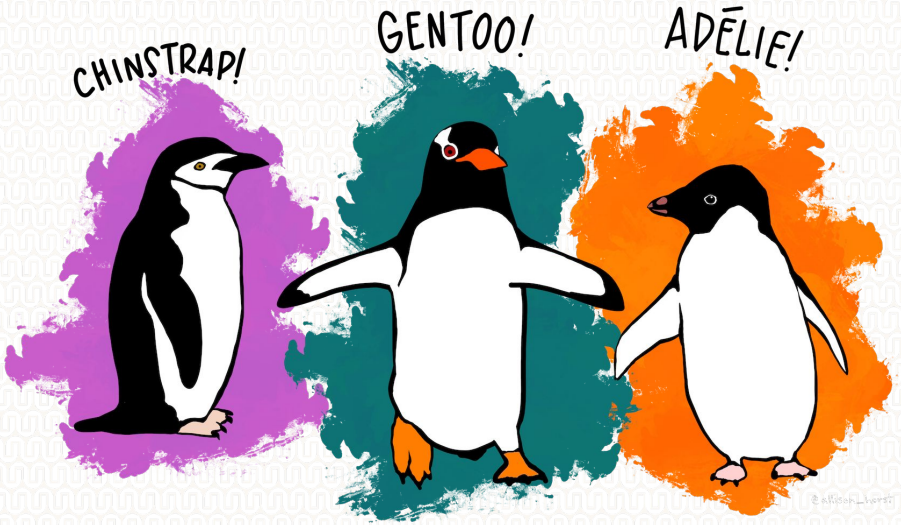
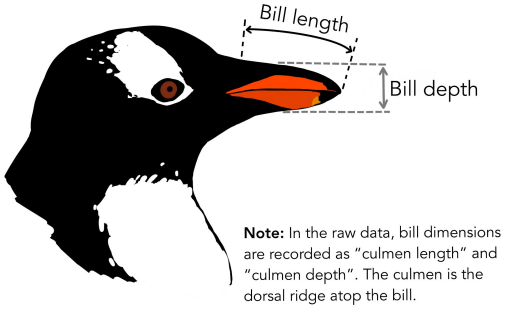
Training a penguin species classification model





https://allisonhorst.github.io/palmerpenguins/

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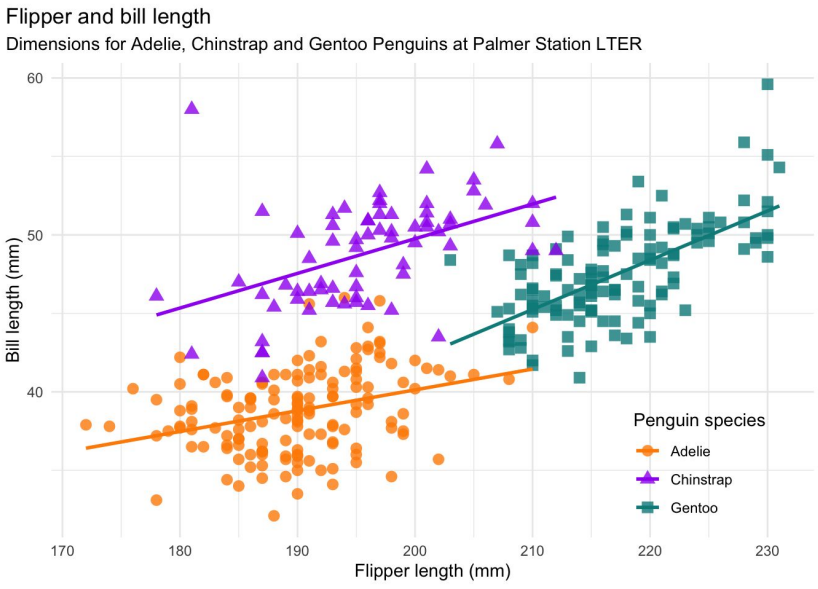
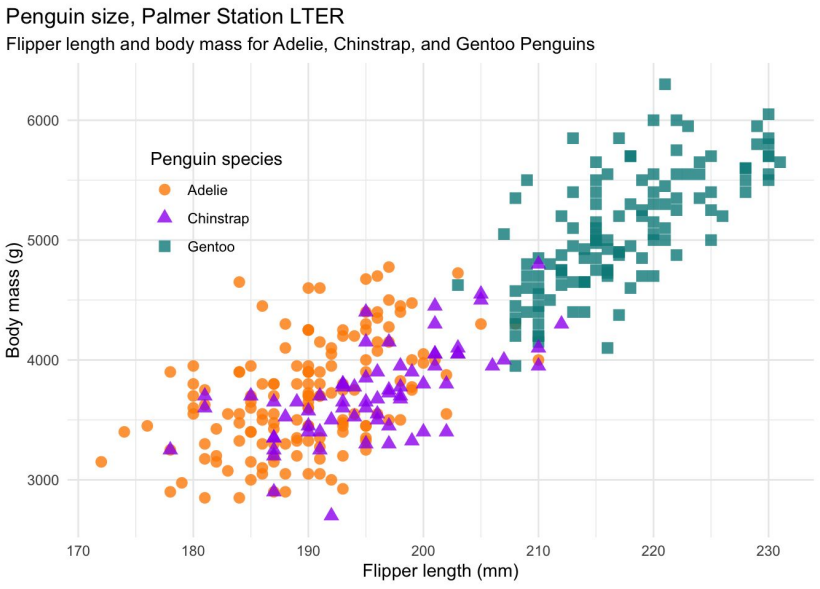
The data:





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It’s showtime!

https://tinyurl.com/pydata-seattle-2023-tutorial

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Summary

🛫 Flyte orchestrates compute, data, and infrastructure

⛑️ Type safety means you can catch compile-time bugs early

↩️ Container-native tasks ensures reproducibility

🏔️ Scales your production workflows seamlessly

🤖 Supports the canonical data science and ML tech stack

🛠️ Easily customizable and extendable

🤝 Breaks the data and model silos between teams

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Getting Started with Flyte

📖 Follow our Getting Started Guide:
https://docs.flyte.org/en/latest/getting_started/index.html

👋 Join us on Slack:
https://slack.flyte.org/

💻 See the Code:
https://github.com/flyteorg/flyte


UNION Cloud
Harnessing the Power of Flyte™ without the Overhead
Flyte™ is helping organizations like Spotify and Lyft build a new generation of products that make elegant use of complex data and machine learning. Now Union AI, the team behind Flyte™, has created a managed version of the workflow orchestrator, freeing data and ML teams from infrastructure constraints and setup.
Try Union Cloud

We're Hiring!

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PyData Flyte Happy Hour

4/27 @ 7-9pm Pacific
Location:
Locust Cider Redmond
7425 166th Ave NE Suite C110
Redmond, WA 98052

https://go.union.ai/ltFcSgnm